THE JOURNAL OF GAS LIGHTING
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VOL. LXIV. No. 1627.] LONDON, JULY 17, 1894. [46TH YEAR. PRICE 6d.

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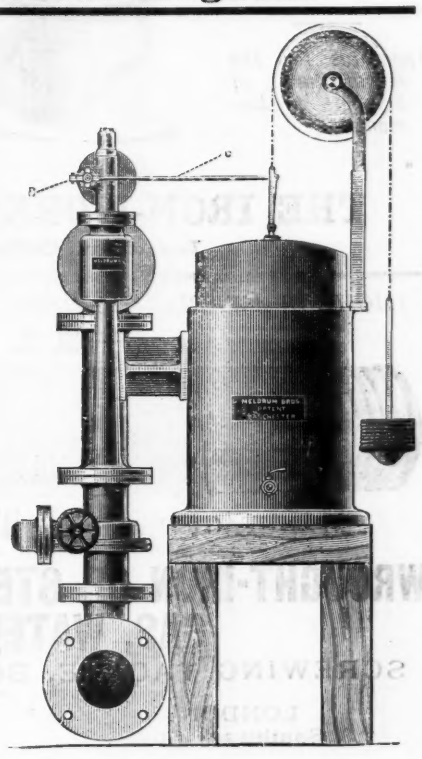

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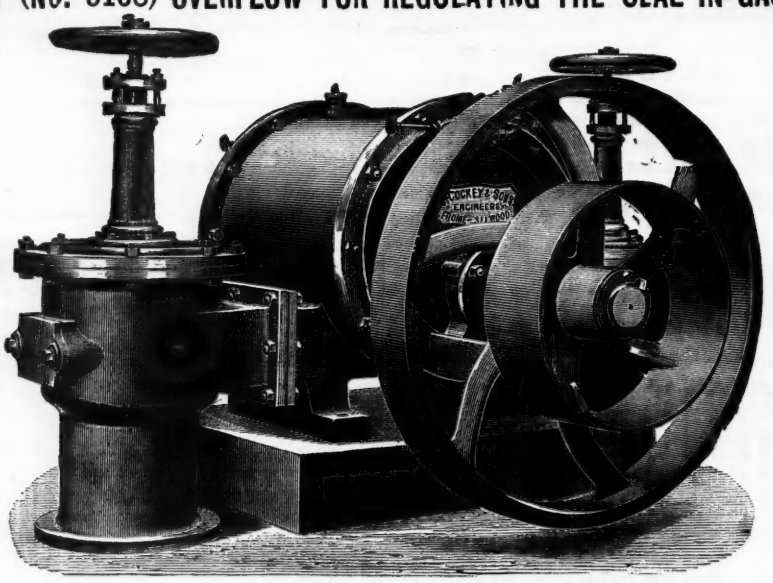

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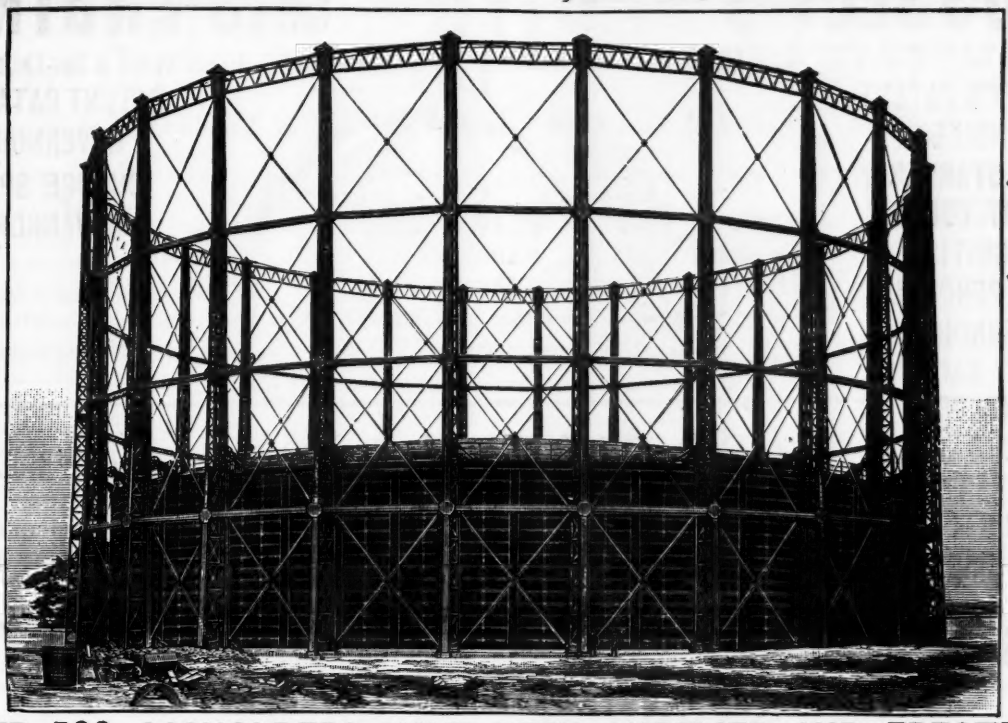

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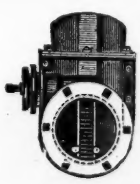

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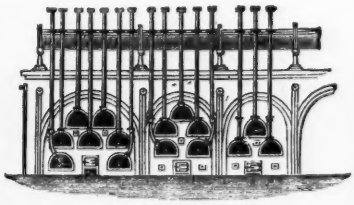

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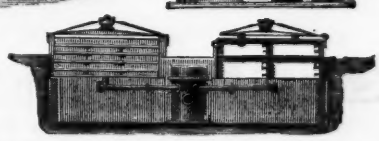

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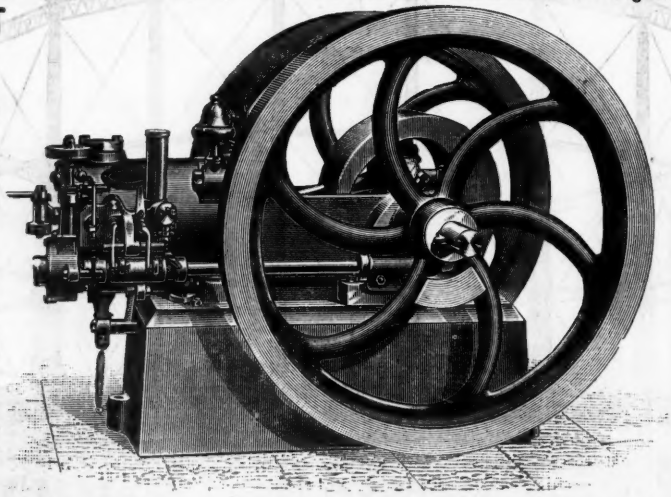

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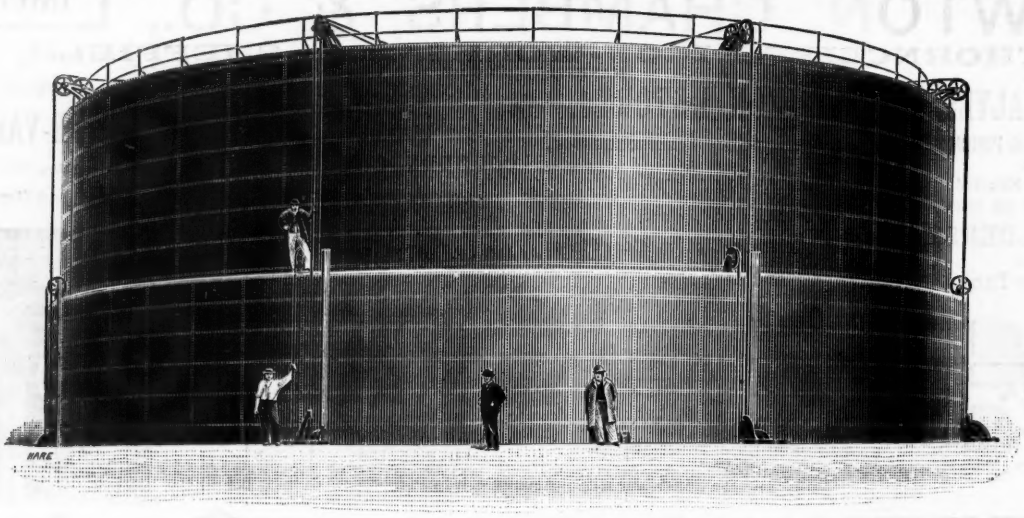

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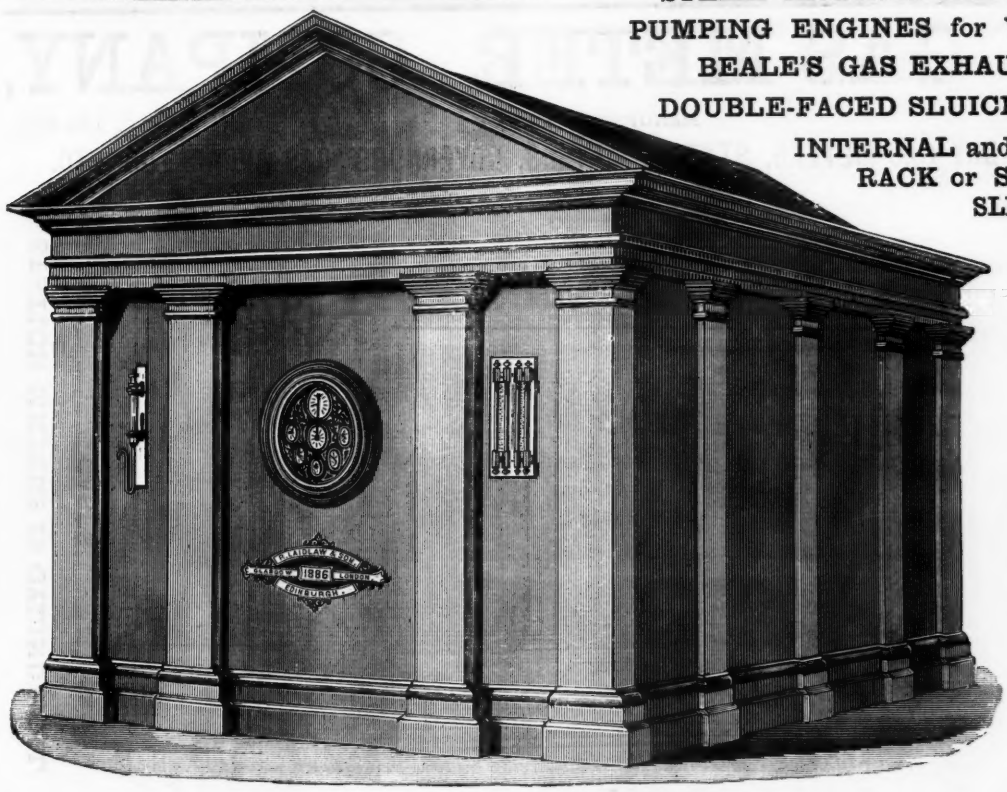

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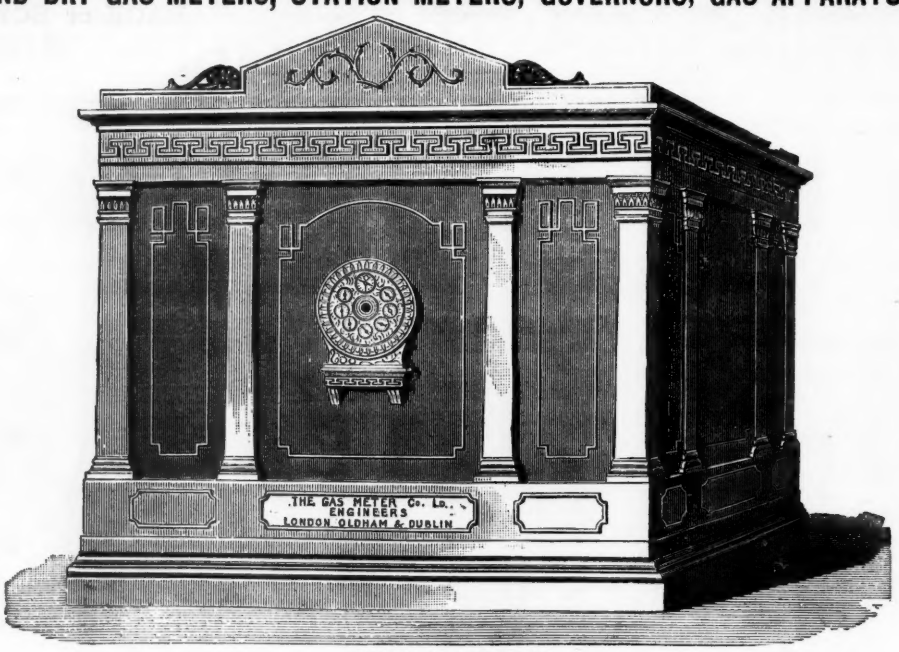

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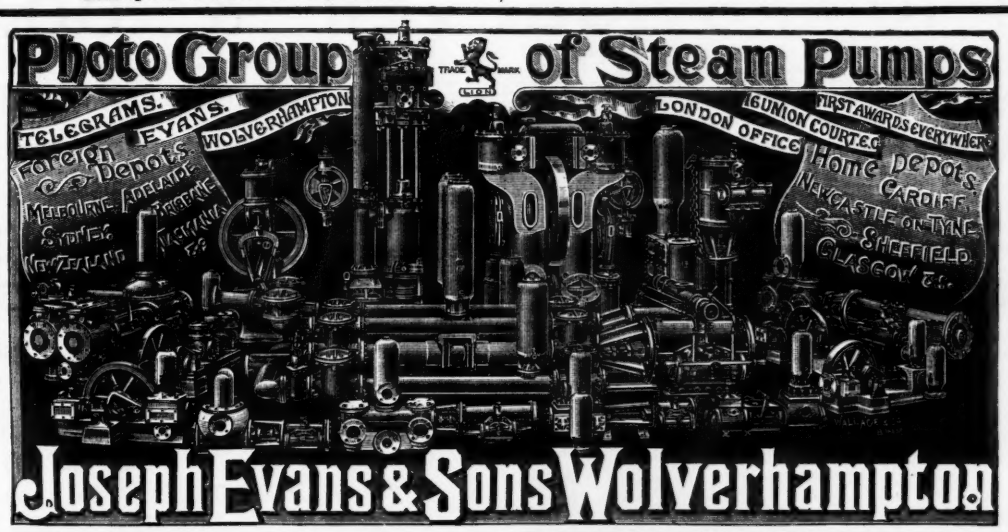

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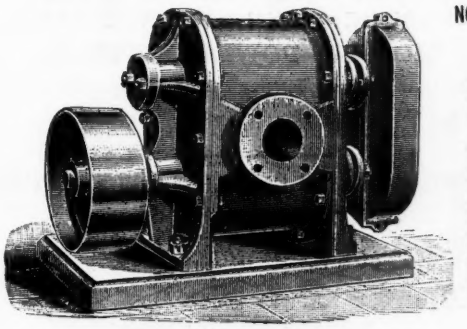

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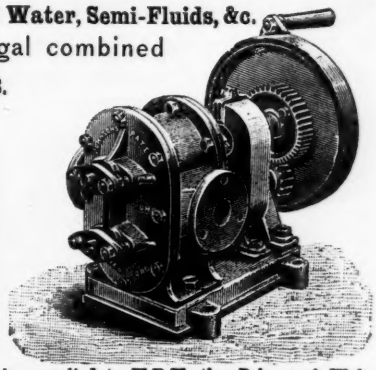

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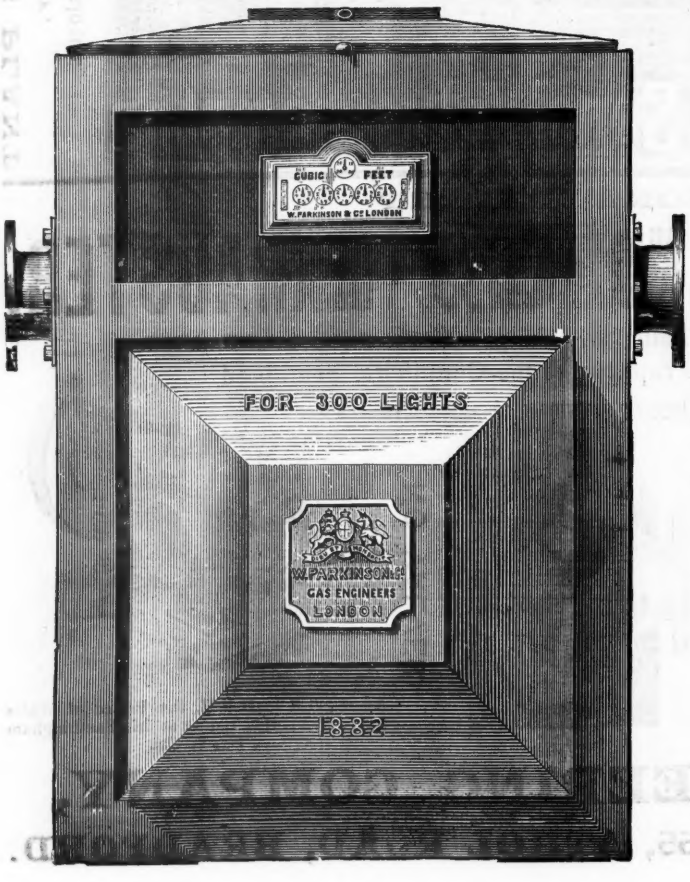

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NOTICE AS TO PAYMENT OF SUBSCRIPTIONS IN ADVANCE.

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THE

JOURNAL OF GAS LIGHTING,

WATER SUPPLY, & SANITARY IMPROVEMENT.

TUESDAY, JULY 17, 1894.

Criticisms of Mr. Dibdin's Reports on London Gas.

IT was hardly to be expected that Mr. W. J. Dibdin's pronouncements upon the question of the illuminating power and the testing of London gas would be allowed to pass without protest from those whom his reports accused of committing something practically indistinguishable from fraud upon the public. Accordingly, Mr. T. Newbigging has sent us a letter in which he lets Mr. Dibdin down gently, by treating his statements on the illuminating power question as those of an official, more concerned to administer the law than solicitous of seeing the law established upon an amended basis. Mr. Frank Bush, Secretary of the South Metropolitan Gas Company, has, however, met Mr. Dibdin's attack by a strong letter addressed to the Clerk of the London County Council; and we give the Company's case the same publicity that has been accorded to their official assailant. Dealing first with what is rightly called the "very serious charge made "or at least implied" in the report on gas testing—that, in effect, the Company do not supply the public with gas of the quality required by Parliament, and that their gas is inadequately tested—the South Metropolitan Directors catch their censor tripping; showing that, in order to make the latter point, the Chemist to the Council has taken the average make of the other London Gas Companies against the maximum make of the South Metropolitan. This is an awkward charge to begin with. Then as regards the illuminating power of the gas supplied, the South Metropolitan Board submit that photometry is not an exact science; that much of its result, as ordinarily applied to gas, depends upon the operator, and much upon the instrument. They accuse the 10-candle pentane standard employed hitherto by Mr. Dibdin of being at least a candle too high; and they observe that it is entirely misleading to those who are not experts to continue to report tests made with this "incorrect test-burner." They, in short, accuse the Chemist to the County Council of continuing to use, to the detriment of the Companies, a photometrical appliance which he knew to be incorrect. Naturally, the Directors impeach Mr. Dibdin's special pet—the portable photometer—stating a number of reasons why the instrument is not to be regarded as equally reliable with the apparatus of a fixed testing-station; and they conclude this part of their rejoinder by offering proof that the indications of the portable photometer cited so confidently by Mr. Dibdin could not possibly be correct. The tendency of gas to lose some of its initial illuminating power in transit through mains to long distances is fairly admitted by the Board, who allege that all parliamentary requirements as to gas testing are made with knowledge of, and due allowance for, this fact. The part of the letter dealing with this point is very interesting, as showing the necessity of interpreting the present condition of the arrangements for the testing of the gas supplied to London by reference to history. The impression conveyed by Mr. Dibdin's criticisms in this regard, and the South Metropolitan reply, is that the former has proceeded upon the assumption that the testing of gas is as exact a matter as the examination of water, or even as the check-weighing of coal; whereas the Company argue that it is in reality a conventional operation, yielding indications that are only comparable between themselves when all the conventions are scrupulously observed in every case. The trouble is that the former view is the more likely to catch the popular fancy; and the London County Council are nothing if not "popular." The latter is the rendering that will certainly commend itself to expert opinion.

The policy of consolidation, also challenged by Mr. Dibdin in one of his reports, is briefly but strenuously defended by the South Metropolitan Directors so far as they have participated in it; and they are justified in claiming that all the amalgamations of their Company have redounded to the benefit of the consumers, "for in "every case there was a considerable reduction in the "price of gas in the district of the Company absorbed "by the South Metropolitan." The history of the introduction of the sliding-scale, and the recent movement aiming at a reduction of the nominal illuminating power of London gas, are dealt with in the latter part of the letter, which is as moderate in tone as it is strong in facts. It is impossible to predict the end of the controversy which the South Metropolitan non-carburetting experiment has started; but it is already clear there will be much disputation before the end, whatever it may be, is reached.

Mr. Chester and Others upon Gaseous Firing.

THE papers upon various aspects of gaseous firing for gas-retort benches, headed by that read by Mr. W. R. Chester, which worthily occupied the attention of The Gas Institute during a considerable portion of the time of the late meeting, while they can hardly be said to mark an era in this branch of technics, yet supply a desirable link between

the present and the past of this development of pyrology. Both Mr. Chester and Mr. Travers bore witness to the fact that there is now not the slightest difficulty in adapting the principle to the special requirements of any gas-works; but Mr. Chester did particularly good service in placing upon record, in a systematic fashion, the merits and weaknesses of those early attempts in this direction which, with all their failings, indicated where ultimate success might be sought. It is true that those who remember and took part in those early endeavours might find in Mr. Chester's statements some excuse for remarking once more upon the curious way in which "the "whirligig of time brings about his revenges." But it is better, in chronicling a success gained, to consider the result rather than to reflect upon the controversies through which the endeavour was carried on. For the present, we only desire to add to the comments evoked by Mr. Chester's communication, a reflection upon the change which the introduction of gaseous firing into retort-houses has incidentally wrought upon the whole character of retort-settings and their equipment. It is not too much to say that at the time this development was first seriously taken in hand by British gas engineers, inspired thereto by the accounts published in the JOURNAL of the work of their German colleagues in the profession, the practice of retort-setting and carbonizing methods generally had sunk into a very tame and uninteresting condition. There was little or no theory of the subject; and although very good and careful work was done in the best retort-houses, it had not occurred to many British gas managers that there was a possibility of advance in retort setting and firing beyond the dreams of the bricklayer specialists who had the practical monopoly of this class of work. If engineers concerned themselves at all with the design of retort-settings further than repeating standard patterns, it was with a view to the saving of labour in stoking and of capital in construction. With the arousing of interest in the practical question of the applicability of gaseous firing to gas-retorts, however, came a radical alteration in this regard. The generation and distribution of heat in retort-settings, and their construction with a view to obtaining the best results for the fuel consumed, were approached from a new and more interesting standpoint; and the immediate effect was a vast improvement of all materials and methods necessary to the end sought to be attained.

Fire-bricks were examined and selected with more care, resulting in a marked advance in their manufacture. The disposition and proportions of chimneys, flues, chambers, piers, and ironwork fittings of retort-benches were reconsidered; and while the practical experience of the retort-setting workmen was not overlooked, their handiwork was directed to the attainment of purposes foreign to their custom-ruled ideas. The German models were imported, studied, criticized, and ultimately to a very great extent superseded. British common sense tested, and ended by rejecting, refinements of design which were found to have no sufficient economical justification; and finally a standard of retort-setting practice was evolved which hit the happy mean between scientific pedantry and "rule-of-thumb." Now every gas manager can have the gas-furnace he requires, and can rely upon getting such carbonizing results day after day, week in week out, as were a few years ago hardly attainable by the most painstaking retort-house management, backed by any amount of capital and the highest skill. More improvement has been achieved in this branch of technics during the last fifteen years than during the thirty years immediately preceding the germinal year 1879, notwithstanding the fact that the principle of recuperative gaseous firing was introduced by Frederick Siemens about twenty-three years prior to this era.

The North British Association Programme.

THE Committee of the North British Association of Gas Managers have issued their programme of business for the forthcoming meeting, which takes place in Glasgow on the 26th and 27th inst. This year there are only three papers, which by some will be considered an improvement on late years, when too much new matter offered, and there was not time to overtake it all. The proceedings will open with the discussion upon the paper by Mr. J. Ballantyne, of Rothesay, read at Dundee last year, on "Cooking by Gas." Then Mr. A. Yuill, of Alloa, is to read a paper on "The Practical Results of Enriching Coal "Gas from Oils by the Peebles Process at the Alloa Gas-"Works," which is sure to be interesting. Following this there is to be a paper by Mr. W. Young, of Peebles, the inventor of the process, on "Further Developments of "the Peebles Process of Enriching Coal Gas from Oils," in which there is likely to be something almost of the nature of a revelation; Mr. Young having been, as is well known, very busy with experiments all along. It is likely, we learn, that he will take the opportunity of stating the case for enriching, as a counteractive to the outcry which has been raised in favour of gas of low illuminating power; and a spirited discussion should arise. The last paper is to be given by Mr. R. S. Galloway, of Edinburgh, the agent for the Incandescent Gas-Light Company, who is to contribute "Notes on Incandescent Gas Lighting." There is quite sufficient in this, with the address of the President—Mr. James M'Gilchrist, of Dumbarton—for an entertaining and profitable meeting. On the second day, the members hold their excursion, as usual. This year they will visit Loch Lomond; dining at the Tarbet Hotel.

The Redhill Gas Company's Rating Appeal.

IN another column will be found an addition to the already voluminous record of gas-works assessment cases; this being the appeal of the Redhill Gas Company against the increased rating of their property in the parishes of Reigate and Nutfield. The gross value in the old list for the Reigate parish was £3281, and the rateable value was £2412. The new rate was £4200 gross, and £3200 rateable. Roughly speaking, as Mr. Boyle told the Court, for the appellants, this was an increase of between 30 and 40 per cent. on the rateable value; while the increased assessment for the property in Nutfield—a small portion —was from £32 to £100. Early in the present year, the Assessment Committee employed Mr. C. F. Jones to make a re-valuation of the Company's property upon the usual terms—not the less open to question on this account—of remuneration by results; and this gentleman experienced no difficulty in fixing the value at £4926 gross and £3926 rateable. The Company naturally objected, in view of last year's trading experience; and they succeeded in getting a reduction of £726, which failed to satisfy them. They therefore took their remedy, and appealed. The result was such as to justify their resistance; for the Court reduced the Reigate assessment to £3500 gross and £2500 net. The appeal was consequently allowed, with costs. The issue turned in a great measure upon local considerations, and also upon the question as to what was a proper allowance for the stock of coal. The small Nutfield valuation works out very differently to that of Reigate, which renders it most difficult to understand what figures or reasons guided the Court in making its decision. It seems clear that, according to the valuation in Nutfield, that appealed from in the case of Reigate was not so very extravagant after all; whereas if Reigate were followed, the assessment of Nutfield would appear to be an overcharge. However, these things are a lottery; and we can only refer to the case as another example of the surprising operation of a free imagination in these matters. The issues appear to have been well fought out on both sides; but our congratulations must be given to the Gas Company upon their successful resistance to an imposition which seems peculiarly oppressive in view of the circumstances with which every gas undertaking has had to make its account during the past year or two, and which are by no means relegated to the realm of the historical.

The Condition of the Coal Trade.

THE coal trade appears no nearer a real settlement of the conflicting claims of employers and employed than it was before the historical Rosebery Conference. It seems necessary to make this observation, because indications are not lacking of a disposition on the part of critics of the gas industry to make light of the possibility of gas making being either interrupted or seriously interfered with at any future time by a failure in the supply of the requisite raw material. There must be something wrong with the organization of a trade that allows of such sectional stoppages as we now see in Scotland, while the next adjacent fields are in full work. And in so far as the latest device for preventing and composing miners' differences with their employers depends for its efficiency upon the strength of organization of the two parties in the coal industry, any failure in this latter respect vitiates the prospects of the former. The miners' leaders feel this difficulty

acutely; and they are reported to be concerting measures for formulating a national policy for the protection of the labour of their supporters. It is hard to understand, however, how the natural competition of the output of one district with another, and of the foreign with the home trade, can be dealt with by any counsels to be taken by the miners; and it is this that governs the issue. Meanwhile, it is hoped that the employers and miners in the Federation districts may be able to agree upon terms to take the place of those determined at the Rosebery Conference, which will run out in November next. Both sides are approaching each other very gingerly; and a really small matter may precipitate a catastrophe. But it is in contemplation that, by the adoption of a compromise, whereby the employers will concede the principle of the "minimum wage," and the men will accept a small immediate reduction of pay, the repetition of such a calamity as that of last year may be avoided. Some of our contemporaries, writing on this subject, seek to make it appear that orthodox political economy will suffer a serious blow if the principle of the "living wage," of which so much was heard last year, is accepted in the coal trade. This is rather amusing for the ignorance it displays of the very nature of the science in question. One can no more give a shock to political economy than one can "hit the nominative case with a stick." This factor of the "living wage" is already at the bottom of all conceptions of industrial economy; because it represents the minimum cost at which labour can be obtained for any industry, and consequently goes to make up the prime cost of production. What orthodox political economists have to say on this subject is that the cost of labour is just so much to be considered as a factor of the total prime cost of production, as the cost of rent, or of any other item on the expenditure side of the producer's accounts. It also goes on to say that, constituted as the trading world is upon a competition basis, it does not follow that an increase of any of these items renders the whole product more valuable to the purchaser. Where there is no monopoly, the prices must continue to govern not only wages, but also rent, interest on capital, and everything else on the debit side of the account. With a monopoly, a producer can do anything in the way of paying wages, rent, and so forth, provided he stops short of forcing up the price of the product to a limit beyond the prospective purchaser's means and desires. With an open market, the producer who has the lowest charges to bear governs the price, in conjunction with the public demand. This is the long and short of the sense in which prices govern wages; and they are no friends of either producers or consumers who create or foster delusions in this regard. We are second to none in desiring the welfare of the British coal miner, but we also desire to see British coal continue in demand; and it should not be beyond the wit of man, even in an age of trade competition, to devise some means for harmonizing the two ends.

The Latest Chicago Exhibition.

Last year there was an exhibition at Chicago, designed to show that the industrial organization of the United States, upon a Protectionist basis, was competent to produce results equal to anything the world could bring in competition with them. The world, as represented by foreign designers and manufacturers, was remarkably indifferent to this challenge, and allowed native judgment to go against it almost by default. This year there is another exhibition at Chicago, which, whether designed or spontaneous, goes to show the degree of success that has been attained by the operation of Western ideas in regard to the organization of the forces of Capital and Labour. It is by far the most instructive of all the exhibitions that have hitherto been held upon the soil of the United States. It is not for us to recount the story of the gigantic strike that arose out of the announcement, by a "model" employer, of the elementary statement that the condition of trade did not warrant him in paying more than a certain price for labour, which price was beneath the arbitrary standard of acceptability fixed, without consultation with him, by his workpeople. The rest of the civilized world has heard with sorrow, but not surprise, that this industrial misunderstanding has eventuated in shooting; and that the old game of the "tug of "war" was being played for the mastery of Chicago and the parts adjacent, between the forces of the community and those of a section of the population claiming to represent organized Labour. It is all a dreadful satire upon modern industrial make-believe, as well as upon the ideas of the Peace-at-any-Price party. Of course, the Chicago strike soon led to shooting, as will every dispute upon the merits of which the parties feel strongly enough. But meanwhile it is made abundantly evident that the new Western world, which was once credited with the capacity for redressing the balance of old civilizations, has changed considerably since the period when that sentimental composition entitled "The Irish Emigrant" was written. It appears that M'Kinleyism has failed to preserve that modicum of "bread and work for all" which was supposed by the writer of the lyric in question to await emigrants to the States who were in want of the one, and willing to perform the other at current rates; and consequently the poor old world must needs go on its way according to its lights, trusting to its salvation from anarchy to the same old methods that have proved efficacious to this end hitherto.

WATER AND SANITARY AFFAIRS.

The decision of the Select Committee of the House of Lords to pass the preamble of the East London Water Bill is a testimony to the merits of the scheme embodied in that measure, and at the same time discredits the arguments advanced by the London County Council in opposition to the Bill. A similar comment may be applied to the corresponding result in the case of the Southwark and Vauxhall Water Bill, where the proposed outlay is as much as £750,000, of which £450,000 is for additional reservoirs immediately above Hampton. The Bill of the East London Company was to authorize the raising of £500,000 for the enlargement and extension of works, so as to meet the wants of a rapidly increasing population, chiefly situated in Essex, outside the Metropolitan boundary, and therefore beyond the jurisdiction of the County Council. Mr. Binnie himself, the Engineer to the Council, had stated in a report on the subject, that if the Water Companies were to continue to perform the duties imposed upon them, "further powers of some kind must "be conferred." The question was therefore narrowed to a consideration of the extent to which these powers should go. Mr. Binnie, when giving evidence before the Select Committee last week, appeared to hold the view that, so far as reservoirs were concerned, the East London Company had no need to extend their works, as they had the largest storeage of any Water Company in London. This view was presented in other words by Mr. Freeman, who, in addressing the Committee on behalf of the County Council, said he did not object to the Company having sufficient powers to ensure a supply "for the next ten "years;" but he asked their Lordships not to authorize any further reservoirs or permanent works. The learned Counsel pleaded that the expenditure should be restricted to mains, pumping, and such matters as were required for immediate necessities. This brilliant idea as to getting an enlarged supply without any increase of reservoir capacity showed an utter disregard of those conditions which are involved in a well-regulated supply of water, sufficient in volume and effectually purified. With respect to the wells, Mr. Binnie thought that £40,000 would be sufficient, instead of £80,000, for the pumping machinery. No new or enlarged reservoirs in connection with the stream, and a stinted supply of machinery for the wells, represent what the County Council think sufficient for the wants of a vastly increased population during the next ten years. But as it takes a long time to construct waterworks of any kind, the Council suggest that an extra year or two will make very little difference; and the request was laid before the Select Committee that, as the Council were going to bring in eight Bills for the purchase of the existing works in the next session of Parliament, the whole scheme of the East London Bill should stand over.

When Mr. Freeman, in cross-examination, pressed this view upon Mr. Bryan, the Engineer to the East London Company, the latter rightly declared that "it would be a "monstrous thing to prevent Essex having a good supply "of water while the County Council were making up their "minds." To this it may be added that, when the Council have made up their minds, there is the chance that Parliament may differ from them. The end is not so easily reached as the Council seem to assume. A deficient

supply in a populous district is a fearful thing; and the public safety must be secured, even though the requisite measures may thwart the designs of the County Council. The Corporation of West Ham, presiding over an enormous population, desire that the East London Bill should pass; and the Corporation of the City of London, though less directly concerned, are also favourable to the measure. The County Council want to buy up the Companies without paying for new works, or incurring the responsibility to construct them. This consideration governs all their policy; and could they only carry their point in Parliament, serious suffering might befall a widely extended district. The County Council are now going to invite the extra-Metropolitan authorities to a conference on the water question, obviously in the hope of winning them over on the subject of purchase. The Essex authorities must be particularly pleased with the invitation; and perhaps others may feel a little dubious. Another step to be taken by the Council, if they adopt the recommendation of the Water Committee which comes before them to-day, is to establish a number of rain-gauges somewhere in Great Britain, outside the Thames Valley. The estimate for them amounts to £365 for establishment, and £330 per annum for maintenance. The information to be obtained by this means is declared to be "absolutely indispensable," to enable the Engineer to report upon "the site and yield of "different sources of water supply."

The tactics of the London County Council in reference to the Thames Conservancy Bill have been admirable. The Council have compromised with the Conservancy; and the explanation is given in the *quasi*-official columns of *London*, where we read: "If it was found that the "Conservancy's Bill could not be defeated, compromise "was the safest course; but it will only postpone a final "settlement of the question." In the House of Commons, it was declared that the settlement arrived at was "final "under present circumstances." The terms of the compact were simply that two more representatives on the Conservancy Board should be granted both to the County Council and the City Corporation, making six for each. As we intimated the other day, this could not compass all the wishes of the Council. Of course it does not. The subject of revenue will be raised before long; and as rating power will be proposed, the mode of representation will come under review. The variation in the ideas expressed by the President of the Board of Trade to a deputation the other day, and in the House of Commons last week, is rather remarkable. All argument for a Hybrid Committee was abandoned on the later occasion; and, instead of depreciatory criticism, praise was bestowed on both Mr. Jackson and the Select Committee. Something must surely have happened in the interval.

Title-Page and Index to Vol. LXIII.—The title-page and index to Vol. LXIII. of the JOURNAL (January to June, 1894) will be ready in a few days; and, as usual, a copy will be forwarded post free by the Publisher, on receipt of a post-card from any subscriber.

The Charges for Gas in the Metropolis.—The Public Control Committee of the London County Council have prepared a report (to be presented to-day), in which they refer to the letters and petitions they have received, complaining of the higher price for gas charged by The Gaslight and Coke Company on the north side of the Thames, compared with the south. Reference is made to the statements of Colonel Makins, and to the report of a speech by Mr. George Livesey, as given in the JOURNAL. In order to decide between the conflicting statements thus put forth, it is recommended that application should be made to the Board of Trade to hold an inquiry on the subject, including the present management and working of The Gaslight and Coke Company.

Death of Dr. Schilling.—The current number of the *Journal für Gasbeleuchtung* contains an obituary notice and portrait of Herr Nikolaus Heinrich Schilling, founder of that publication, and General Director and Consulting Engineer of the Munich Gas Company, whose death took place on the 3rd inst. In a few expressive sentences, our contemporary records its sense of the loss the Company, as well as the gas world at large, have sustained by this event; for the deceased was thoroughly conversant with both the technical and the administrative branch of the gas industry, and his fame extended far beyond the undertaking with which he was connected, and even beyond the Fatherland. The benefit of his instruction will be gratefully recognized by all who have had the advantage of it; while his characteristic amiability of disposition will be keenly missed by those who were privileged to have personal intercourse with him. Herr Schilling was an honorary Doctor of the Ludwig-Maximilian University of Munich.

THE INCORPORATED GAS INSTITUTE.

PROCEEDINGS AT THE THIRTY-FIRST ANNUAL GENERAL MEETING,

HELD AT THE

WESTMINSTER TOWN HALL, JUNE 19TH, 20TH, & 21ST, 1894.

JOHN WEST, ESQ., M.Inst.C.E., President.

PAPERS AND DISCUSSIONS.

We continue to-day our record of the proceedings at the above meeting by giving the discussions on the paper read by Mr. W. R. Chester (*ante*, p. 27), which was taken with those of Messrs. Travers and Cleminshaw, and on that of Mr. Chew. The latter papers appeared in the JOURNAL last week. We also give to-day Mr. Chadwick's paper, entitled "My Experiences with Some Leaky Gasholder Tanks."

DISCUSSION ON THE PAPERS BY MESSRS. CHESTER, TRAVERS, AND CLEMINSHAW, ON REGENERATIVE RETORT-SETTINGS AND GASEOUS FUEL.

Mr. W. A. VALON (Ramsgate) said he must congratulate Mr. Chester on the very excellent paper he had given the members, and also upon the great measure of success which had attended his efforts in the construction of regenerative furnaces at Nottingham. It seemed to bring together all the knowledge gained up to the present time by the hard work of others as well as himself. There could be very little to say as to the structural part of the settings, which were now so well known to nearly every gas engineer and manager, though at one time this was not the case. He might, however, just say a word on the question of cost. Mr. Chester had given the comparative figures commencing with the cost of settings introduced many years ago by himself and others; but the cost of these, when contrasted with his later ones, would naturally come out high, because in the early days no one knew exactly what to order, or the way in which certain classes of fire goods, &c., should be used. Therefore, the cost in those days was not comparable with that now given. At Nottingham, possibly some materials arising from the old works pulled down might have been re-used. But whether or not this was so, it was well known that in the Nottingham district fire-bricks, iron, and such-like materials were exceedingly cheap, compared with many other parts of the kingdom; and, therefore, other managers could not be expected to set up similar plant for the same money. They were all apt to be judged, by those to whom they were individually responsible, by a standard set up; and if that standard were exceeded, they might be found fault with because they did not do so well as others were doing. Therefore, these local conditions must always be taken into account. Another matter on which a word might be expected from him was the remark, in the early part of the paper, calling attention to what he had done in connection with generator and regenerator firing. To his mind, it conveyed a meaning which he was quite sure was unintentional on the part of the writer. Mr. Chester, in dismissing his (Mr. Valon's) work from among the pioneers of generator firing, conveyed the impression that the structures with which he was connected were faulty, because, in the long battle of the furnaces, one incident occurred where the word "fallacious" would apply. The fact was that, from surrounding circumstances, he came to a conclusion which was not tenable, and which he was the first to withdraw as soon as he discovered he was in error. Mr. Harold Dixon, who had been referred to, was so far impressed during the discussion, that, after a time, he wrote to the press as if he believed something which had not been acknowledged or recognized before had been discovered; and it was so. His words were: "Mr. Valon is right, or there is another underlying principle, and that is that air must be instantly heated, instantly cooled, or not heated at all." This was a fact which neither Siemens nor anyone else up to that date had recognized. The one fallacious statement which was made in connection with

the construction of these earlier regenerators was that air was not heated in channels. But the structures themselves did not suffer from this assertion; and to convey the impression that they were therefore built on a false notion, was altogether a mistake. The structures were in position still; and they were doing quite as good work as those which Mr. Chester had described. The only mistake he had made was that he simply endeavoured to explain by theory what occurred in practice. The fact was that, only the year before, Mr. Siemens, as some of the members would recollect, in discussing a paper read by Mr. Foulis, said it was impossible to heat air in channels sufficient for regeneration; and it reminded him of his early mistakes. But Mr. Siemens was wrong, because it was proved that not only were the channels sufficient, but more than sufficient, and could be reduced; and the structures very much simplified, and made more substantial, so that one could do away with the extravagant mode at first adopted of putting these things together. It was this that brought him into the field, commencing *de novo* with a generator furnace; and, finding there was great benefit which was at first denied, it naturally led up to the condition of things he described, and to the understanding of principles not hitherto known. These principles he claimed to have been the means of discovering—viz., that only a very short run of channels, such as Mr. Chester had shown them by his own drawings, was necessary to heat the air up to the necessary point for combustion. He would not go farther into that matter, except to say that the structures of to-day, guided by the experience of the past, had gone on improving. It was some fifteen or sixteen years since the pioneers of regenerative firing in England began their work; and there were other men whose names should be associated with it. Mr. Webber made perhaps one of the first down-draught generator furnaces at the Phœnix Gas-Works; but it did not at the time receive the attention it should have had. Then there was the late Mr. Somerville; and there was the President's own work, which he (Mr. Valon) had the pleasure of seeing in 1878 and 1879. From this he had derived a great deal of instruction; and it should not be forgotten. Then there was Mr. Livesey's work, and Mr. Frith, of Runcorn, who were all pioneers in helping to bring a knowledge of regenerator furnaces to the point at which it had now arrived. Nor must they forget the work of Mr. Carpenter. Undue prominence should not be given to one special incident, which might obscure the work of the pioneer men who had laboured hard to make generative and regenerative firing what it had become to-day in connection with the destructive distillation of coal.

Mr. W. H. Y. Webber said that he rose with considerable diffidence to speak on this subject, in reply to the President's invitation. It was a matter which he had followed very carefully for the last fifteen or sixteen years; and he had come to the conclusion that it was exceedingly difficult, in tracing out the course of a movement of this kind—the introduction of gaseous firing into retort-houses, which had been of such great practical benefit to all who had taken it up—to realize again what the condition of practice was at the time when the movement was started, and the share which should be assigned to all who put their hand to the work. He must felicitate the author of the paper on his success. There was no doubt that his arrangement was one of the best now available. He had had the great advantage of watching the failures of some of the earlier men; and he was not too closely identified with them. At the same time, he was near enough to see without a telescope where their weak places lay. Mr. Valon had referred to some work which he (Mr. Webber) had done in 1878 for the then Phœnix Gas Company at Bankside, under Mr. Corbet Woodall; and he did not think the story of those experiments had really ever been told. He had a very clear remembrance of what took place in those days; and it might be rather helpful to show what the condition of retort-house practice then was. When he turned his attention to the subject, he found there was no theoretical help to be had in the way of improving the working of retort-furnaces. He had had experience for some time before that in designing direct-acting furnaces of all kinds; and in the course of his work, he had made one or two little discoveries of his own, one of which was that it was good business, in dealing with an old-fashioned setting of sevens, set as two, three, and two, with the middle retort over the furnace, to turn out that retort, to increase the size of the others, and to provide a large combustion chamber. Many others had made the same observation; but he claimed personally that he had found this out for himself. Then he began to study the possibility of conducting the intense heat away from the fire. They used to work then with the old-fashioned double doors, one above and another below, with the old direct-acting furnace; and he found, in trying to keep up good working heats in the retort-setting, that the heat immediately over the bars was very high. One could not look into the furnace. Then the idea of making the furnace gaseous occurred to him; and, like a good many others seeking for theoretical light on the subject, he turned to their old friend Box. There he found a "facer," to begin with, in the statement that it was a positive fact that there was no advantage whatever, but really a loss of 25 to 30 per cent., in burning carbonaceous fuel first to carbonic oxide, and then to carbonic acid again; so that if they did this, and saved every unit of heat generated, they still stood at a very great disadvantage as compared with the far simpler practice of burning the fuel direct to carbonic acid. There was a "facer;" and how were they to get over it? He thought that doubtless the theory of the matter was right; but, as a fact, the practice of it was wrong. He was certain that, in burning fuel to carbonic acid direct, although they had a tremendous lot of heat, it was where they did not want it—immediately over the bars. If they could divert that heat, and get it somewhere else, so far from being a loss, he believed it would be a gain, not only in the matter of fuel, but also in the better condition of the retort-setting generally, and the reduction of wear and tear. In the course of studying this matter, he was led to devise a retort-setting in which there was a large combustion chamber very much like the one shown in the section of Hislop's patent setting. If they would imagine this furnace filled with coke, and burning downwards instead of upwards, it would give a fair idea of his first gas-generator furnace built at Bankside in 1878. He did not claim that he did anything great with the furnace; for, as a fact, he did not. It was one of the things which were trodden under foot in due course; and other men were able to walk over the top of it, and do something much better. The difficulty was that there was no such thing then as a sunk main flue such as was the practice now; and there was hardly such a thing as a staunch retort-bench to be found. They had a high chimney there, with a draught of 8-10ths of an inch. It was considered that this was the proper thing to do—to have a good pull on the furnace the whole stretch of the bench. The consequence was that the farthest bench, which was seven from the chimney, worked perfectly when the damper was supposed to be closed. The draught went through the walls from one to the other; it being a very old stack. They could see now that, under these circumstances, anything like an efficient arrangement of gaseous firing was not only difficult, but impossible. Just at that time the Germans were working at the matter very hard; and they found a thing which he wished he had known before, and which had been of incalculable advantage to everyone since. They discovered the office to be fulfilled by steam in preventing the formation of hard clinker, by reducing the temperature at the point of ignition; thus enabling the fires not only to burn openly and well, but to be easily cleaned. He did not know who ought to have the credit of the discovery; but that was a further stage. Then they went on from one thing to another—one man did a bit, and another man a bit. As Mr. Valon had remarked, the late Mr. Somerville was one of the most fruitful and successful workers in this line; and they all knew what an amount of agitation there was on the subject. Some people, following Siemens's lead, thought it was necessary to have a tremendous amount of regenerative power; and it was only when Mr. Somerville, Mr. Valon, and Mr. Carpenter proved that, so far from it being necessary to have this powerful battery of regenerators, a very short run through a hot flue had exactly the same effect, that the regenerator furnace as they now knew it become a practical success in England. He had only to thank Mr. Chester for the clear way in which he had put the matter before the meeting, and for the admirable system on which he had worked out the whole of his results.

Mr. T. N. Ritson (Kendal) said he noticed Mr. Chester stated that the length of life of the retorts at Nottingham was 1100 days. This seemed a very extensive lifetime, and he (Mr. Ritson) thought few could boast of such a

long duration. He should like to ask Mr. Chester if there was any particular material, or fire-brick, &c., which he used in the construction of his settings, or was there any particular feature in the setting itself, different from other settings on the recuperation system, as he was unable to get such a lifetime out of the generators at his works.

Mr. G. Anderson (London) said he should like to make a remark, not so much in criticism of the papers before the members, because they were getting to quite understand now that gaseous firing was a thing of the future. He remembered the time when, in large gas-works, he had seen every sight-hole in front of the setting open for the purpose of giving more draught to the furnace; and out of each hole was coming a flame of carbonic oxide, which was ignited in the retort-house—consequently causing an immense waste of fuel. This would not go on any longer, because they now understood that, if they saw a flame at the top of the chimney, as he had often seen, this was fuel which ought to have been consumed in the retort-beds. The settings of retorts with gaseous firing which were put on the top of sunk beds were undoubtedly the best form in which they could be constructed. But there were many places—and he himself happened to be connected with several—where they could not go down, for reasons similar to those which Mr. Travers had stated; there being water in the ground. But, being thoroughly convinced of the benefit of gaseous firing, he had for some time been paying attention to the subject, to see if he could have it in settings fired from the floor. The carrying out of this had been accomplished by his youngest son and assistant. They had talked the matter over from day to day; and ultimately it was put in practice. They did not succeed the first time, as they had rather too much heat; in one place and too little in another. This only showed their ignorance of how to distribute the heat; for there was no doubt about having plenty of it. Then they let down the setting after some months' work, and made a few slight alterations; and it was now acting satisfactorily. They had put up several of these settings in different works; and he was quite satisfied that, both in economy of fuel and in the duration of the retorts—though the latter point was only an hypothesis at present—there would be a great saving. With regard to the life of the retorts, Mr. Ritson had stated that he could not get them to go 1100 days. He (Mr. Anderson) used to keep a "duration book;" and then he often had a life of from 1000 to 1100 days in retorts—letting them up and down perhaps two or three times. But in a regenerative setting he expected a greater duration than was possible with a common furnace, and for this reason: The life of a retort did not depend upon the quantity of coal it carbonized, nor upon the time it had been set, but upon the accidents of its life. One of these was the furnace being allowed to become empty—cold air getting in and cracking the retorts. They knew this should not be, although it was one of those things which would happen sometimes; and they also knew that, in clinkering a common furnace, they had to empty it, and let the door remain open while clinkering, during which time the cold air rushed past the retorts, and endangered their lives. In the gaseous firings he had adopted, if there were seven retorts, he took out the centre one, though seven retorts in a furnace was a thing he condemned thirty years ago, and had taken them down wherever he had found them, and had put up six, so as to get a larger combustion chamber and a better result. They had six retorts in the setting; so that they had a furnace with about 3 feet of coke, as a rule, still leaving considerable space above for combustion to take place when the secondary air came in. When the men had to clinker sometimes every 12, at others every 24 hours, he pushed in from the front two or three bars of iron (which he called temporary bars) about 6 inches above the primary bars. Thus he separated the whole of the coke above, and took out the ordinary bars and did his clinkering. This occupied only two or three minutes. Then he put in his permanent bars, and took out the temporary ones; the coke fell a few inches, and there was never any cold air playing on the retorts. For this reason, if for no other, the retorts must have a longer life. If any gentleman would like to see the arrangement, he could look at the drawings in his (Mr. Anderson's) office; or the settings could be seen in operation at Erith, Caterham, or Waterford. He had so far made up his mind about them, that he did not think he should ever erect another furnace of the old kind. Wherever there were two retorts going in the summer time, he should put up a gaseous furnace; and he had done it already, and was satisfied as to the advantage.

Mr. C. Elliott (Leyland) remarked that Mr. Chester had stated that the grate generator was to be preferred to the hearth generator; but he (Mr. Elliott) should like to know why he preferred it in face of the fact that, in the setting before them (Hislop's), there was a hearth generator, which only required cleaning out once in 36 hours. Mr. Chester, in his paper, said the reason he preferred the grate generator was that it required cleaning only once in 24 hours; and it appeared to him that, as Mr. Hislop's arrangement only needed it once in 36 hours, this must be better than the grate system.

Mr. D. Irving (Bristol) said that in the discussion a great deal of attention had been paid to the historical aspect of Mr. Chester's paper, which was only touched upon in the introduction. But, apart from this, there were many figures of the greatest interest given; and, judged from the commercial point of view, it was most admirable. He had furnished the results of a very costly experience, which were now laid before the Institute for the benefit of everyone. He was glad to hear there was no question as to the advantages of gaseous firing; but, in making the comparison, he thought Mr. Chester had taken a somewhat extreme example of direct firing in ordinary settings. He took a case of 28 lbs. of coke per 100 lbs. of coal carbonized. Now he (Mr. Irving) worked generators, and also had a house devoted entirely to direct firing; and in the latter they could get fair results with 24 lbs. of coke. On the other hand, Mr. Chester stated that he was able to reduce his fuel account in the regenerator down to 12½ lbs. per 100 lbs. of coal carbonized. He credited this saving to two items—50 per cent. due to the generator itself, and nearly as much—47 or 48 per cent. to his regenerator or recuperating arrangements. He (Mr. Irving) very much questioned the amount of saving the writer had credited to regeneration; but in order to obtain these advantages, he spent some £50 per mouthpiece. Yet Mr. Valon's experience, as well as that of himself and others, showed that almost as good results could be obtained with a simple generator and secondary air arrangement, costing certainly less than £20 per mouthpiece. This brought up the question: Does regeneration pay? From some experiments he had made with a simple generator, he had found the difference between Mr. Chester's costly setting and a simple generator worked out to something less than ½ cwt. of coke per ton. The question was, did it pay to spend £20 or £30 per mouthpiece for the saving of ½ cwt. of coke per ton of coal.

Mr. Chester said, if he might be allowed to interpose, he should like to point out that Mr. Irving was not making the comparison upon equal lines. The setting he alluded to as costing £50 per mouthpiece included the mouthpiece, ascension-pipe, and all the retort-fittings. The setting to which he referred as a simple generator, costing less than £20 per mouthpiece, was his previous setting, which contained arches, walls, main flues, and regenerator, and the retorts cost £17. It was not right to compare a setting fully equipped with all these fittings with one containing merely the walls and arches—practically the brickwork only.

Mr. Irving said the comparison he was making with a simple generator referred to one in his own mind, which did not cost more than the amount stated. He did not refer to the figures in one of the cases Mr. Chester had given. There could be no doubt as to the great economy of gaseous firing; but the question he wished to raise was whether it was worth while to go to the great expense of costly regenerators to save about ½ cwt. of coke per ton of coal. He should be pleased if Mr. Chester could give them some particulars of his coke. It worked out, from the figures he had already furnished, to something like 11 cwt. per ton of coal carbonized; and he would ask what method was adopted for ascertaining the quantity consumed, because he was convinced that the value of these comparative statements depended upon the method employed in ascertaining the quantity used. He should also be glad if Mr. Chester would furnish them with the quantity of coke sold per ton of coal. He wished to express his obligation to the author for the elaborate statistics he had given. The paper could only have been improved by furnishing some analyses of the quality of the fuel used, and also of the generator gases before and after combustion.

Mr. VALON said he thought Mr. Irving had misapprehended what he (Mr. Valon) had stated. Where heating the secondary air could be accomplished, it was always desirable. He did not mean to convey that what was called regeneration was not desirable, where it could possibly be obtained.

Mr. J. W. BUCKLEY (Falmouth) remarked that during the last seven years he had had some experience with gaseous firing, and was sorry he could not get so low a fuel account as Mr. Chester—viz., 12·5 lbs. per 100 lbs. of coal carbonized. He should like him, in his reply, to give the size of the inlet apertures for the primary and the secondary air, and also the draught of the chimney in each case, where there were separate chimneys; or did one chimney control one or more settings? He should feel obliged to Mr. Travers if he would reply to these questions.

Mr. J. CHEW (Blackpool) said he had had personal experience of various classes of generators, with varying success. A previous speaker had referred to the quantity of coke produced; but, to his (Mr. Chew's) mind, this was altogether a fallacious test, inasmuch as one coal would yield a very different quality of coke for furnace purposes to another. When comparisons of this kind were made, they should be on exactly the same lines; if not, they were of no use whatever. If they took what was called in Lancashire four-feet coal, the coke produced for sale would not reach, by 4 cwt. per ton, so much as by the best Arley coal. Looking at the drawings before them, it occurred to him (Mr. Chew) that one fire might very well take the place of two. They used twelve retorts in a setting. He gave up seven retorts long ago, and adopted six, and used but one fire for a through bed. This was very successful; but his difficulty had been a leakage in the regenerating chambers. The letting down and getting up again of the fires in many instances led to cracks taking place in the brickwork; and the leakage of one sort of gas into the wrong chamber had been a source of great trouble. Notwithstanding this, he still thought the generator plan was far superior to either the regenerative or direct firing. If they went back to the open-firing plan, they would have very great difficulty indeed in carrying on work at the present day with the men at their command. With regard to the duration of the retorts, his own experience was that a great deal depended upon whether they were often lighted up and let down again. This lighting up and letting down did far more harm to the retorts than many weeks of work. The working of his retort-settings, from the time of putting in to the time of taking out, varied from 100 to 120 weeks' actual duty; and during the whole time they were in operation, they might be lighted up and let down five or six times, inasmuch as he had charge of works where the fluctuation of demand was very great. One week there would be a considerable demand, and a number of furnaces would have to be started for holiday times, and so forth. But the next week they would be let down again. An increase of 40 per cent. in the manufacture was no unusual thing, quite apart from the ordinary consumption. The greatest difficulty he experienced was with the settling of the air chambers at the side. On each occasion that he had rebuilt them, he had invariably changed his plan for what he considered a better one. His great aim now was to prevent gas from the furnace escaping underneath, and destroying all the work accomplished by regeneration.

Mr. G. R. LOVE (Dundalk) said he had listened with a great deal of pleasure to the reading of the excellent papers before them, and to the discussion thereon. He was much interested in Mr. Chester's experience, and the cost of the several plans that gentleman had given. One of the greatest objections he had had to the various systems of regeneration had been the application of steam from the outside; and he had to congratulate Mr. Chester on his happy arrangement of the feed boiler, which enabled him to get his steam at a very low cost indeed. At the same time, it was higher than it should be. He was also troubled at the great depth Mr. Chester went underground; and he failed to see any advantage to be gained by it, unless it might be owing to structural arrangements, such as the foundations having to go down to a considerable depth from necessity. He could not see why, where this was not the case, the coke could not be taken away on the ordinary working floor.

Mr. CHESTER remarked that the coke was taken away from the top floor.

Mr. LOVE said this was all the more reason why they should not go to such an enormous depth. Mr. Anderson considered this was the right arrangement; but, from his (Mr. Love's) own experience, he had come to the conclusion that a short run of air-flue coming in contact with the waste gas was quite sufficient to heat up the secondary air to the combustion chamber, and that any great depth was unnecessary. This was one of his reasons for thinking that Mr. Hislop was working on the right lines in his shallow-chamber arrangement. Speaking of Mr. Hislop's system, it occurred to him, in connection with the paper by Mr. Travers, that some members might go away with the idea that it was simply his difficulty with the water that caused him to adopt it; but he (Mr. Love) thought this was not the only reason for adopting the system. It was equally suitable to all classes of works, both large and small. One thing had been entirely left out of the discussion. Most gentlemen had spoken as if the only saving to be derived from regenerative furnaces was in the shape of coke; but he differed entirely from this opinion. He found he had very considerable saving in labour, as well as in the greater quantity of gas produced. In his old style of working, he had six-hour charges; but by the adoption of Mr. Hislop's system, he had four-hour charges, which enabled him to work with half the number of retorts he had in action with the former settings, He worked with Lancashire coal. Mr. Travers, in his paper, had made the same statement—he had half the number of retorts in action that he had at the corresponding time last year; and he (Mr. Love) considered that, if a manager was using half the retorts, he effected a considerable saving in plant, which ought not to be lost sight of in discussing a matter of this kind. By getting four-hour charges, they also saved in wages. Speaking of coke, Mr. Travers said he had a gain of £25 a week from his sales; and from his coke alone he should save the expense of the system in eighteen months. Now, taking the other advantages—viz., the retort-house space, the wages, and the yield of gas—he expected he would make up the difference in one year. This was his (Mr. Love's) own experience. He had had the Hislop system in operation for a year; and it had paid for itself in that time.

Mr. W. CARR (Stalybridge) agreed with the last speaker that, while the great point made in connection with the subject before them was the saving of fuel, anyone who laid too much stress on this was making a serious mistake. He had had large experience in firing with generator and regenerator furnaces; and his first doubt in adopting them was whether they would heat the retorts at all. He believed the system he first tried was one by Sir William Siemens, only altered to work with a generator inside instead of outside, as adopted at that time in Glasgow. He had some doubt whether he could get sufficient heat. But when he started, he succeeded in melting down one setting in three weeks; and when he had them fairly going, his difficulty was to restrict the heat. He satisfied himself that there was abundance of material to work with; and the next thing was to get it under control. The great advantage of the system was that they had control over the settings; they could heat them as they pleased. They could get any amount of heat—sufficient for melting them down or for carbonizing at a moderate temperature, or, if they chose, at a high temperature; and this was the first consideration with the gas maker. What he wanted was to be able to get sufficient heat to work off the coal at the temperature he thought most suitable; and this he could not get with the ordinary system of firing. He was fairly successful with the common setting, as far as the amount of fuel went. He had never reached so low as 24 lbs. of fuel per 100 lbs. of coal; but with one house he got down to 26 lbs. If one could save fuel, it was a good thing; but, as Mr. Irving had remarked, it was not a very great matter to spend a large amount of money to save a few pounds of coke. The first thing was the carbonizing of the coal; and seeing that this system gave all the advantages of sufficient heat, which could be distributed with more uniformity, and could be controlled with greater nicety, and also gave a saving of fuel, there could not be a doubt as to the desirability of working with it. With regard to shallow furnaces, where one could not get depth, it was advisable to try shorter settings; but his advice to anyone who could get depth was to give up the idea of shallow settings, because depth was very essential to the efficiency of working. Mr. Chester's paper had put

on record a great deal of valuable matter, and the Institute was under great obligation to him; for it must have cost him a considerable amount of time and trouble. It was, in fact, one of the most valuable papers ever presented to the Institute.

The PRESIDENT said he was not aware that his name would be introduced in the paper; but, as it had been, he might say a word or two. It was rightly said that he commenced very early with this system of firing, when they did not know much about the principle. Two or three of them, as Mr. Webber had said, had to feel their way. He (the President) had been trying to remember when it was he commenced; and he thought it must have been at the latter end of 1876, or the beginning of 1877. There were about that time only two or three friends with whom one could talk on the subject; and one of them was the late Mr. John Somerville. He (the President) decided that his Company (the Maidstone) ought to do something. He was putting up a new retort-house; and, from the information he obtained from various sources, which was not very much, he thought it wise to make some experiments, and put in two or three settings. In those early times, he found it was one of those things that they had to look after themselves. It was simply a question of plodding away for some time before they obtained satisfactory results; and then they had to find the reasons for what sometimes happened. He fully satisfied himself that there were a great many advantages in the system; but just as he was in the midst of a number of experiments, he was transferred to Manchester, and did not complete them. Mr. Valon and others saw the furnaces at work. He gathered, some short time afterwards, that it was scarcely known whether he or Mr. Livesey or Mr. Webber was the first to make a start; but there was no doubt that they all started quite independently about the same time. When they did get to know they were moving in that direction, they met each other occasionally, and obtained all the information they could. But when he went to Manchester, knowing he had plenty to do there, he did not say anything about his own experience with generator or regenerator furnaces, lest they should ask him to take it up himself; and he thought it would be better if they could find an experienced man, and let him take on the job, pay him well for it, and let him be responsible. The Corporation of Manchester did not know for some time afterwards that he (Mr. West) had done anything at Maidstone in that direction until it came out accidentally in the course of conversation. Then they went up to see the South Metropolitan works. Previously to this, Herr Klönne came upon the scene; and it was decided that he should put up a few settings. All the experiences Mr. Chester had given them, however, were on experimental settings on a large scale. It was laid before the Gas Committee that there was no one he knew of who had a full and complete knowledge of the subject; and, therefore, the settings were all put up experimentally. He could not recommend anything specific. He said the thing had not been sufficiently tried; and therefore Herr Klönne was called in, and he erected the settings. Whatever he dictated was ordered; and he had his own men to work them. Then they thought they would call in Sir William Siemens to put in some furnaces. But they found he knew very little about the practical building of retort-settings; and he made the most miserable failure of all, though he was the most scientific man, for the work only lasted a very short time. This was partly on account of putting in common and unsuitable material; and though he was well up in theory, he did not know much about the practice in carbonizing coal. He (the President) saw these failures, and thought the Corporation were spending too much money on the experiments; and so he decided that he would try again what he could do himself. The first settings consisted each of nine large retorts; and they did very well up to a point. They continued to gain experience with them from time to time; but before they were thoroughly worked out, he left the service of the Corporation, and his friend Mr. Chester and others had the working of them. However, as his present works were very close to the gas-works, he had from that time periodically gone over to see how the various furnaces had been going on. When Mr. Chester removed to Nottingham, of course he had the result of all this valuable experience, which was, no doubt, of considerable advantage to him; and great credit was due to him for the steady progress he had made. This led him to convince the Gas Committee of Nottingham, after the first setting had been in operation for some time, that it would be advantageous to replace all the old furnaces by regenerators. After the first settings of nine retorts at Manchester, they put in some settings of eight retorts, and found that they lasted much longer than the nine retorts; and though he thought that the question had been thoroughly settled in Manchester some time ago, other gentlemen came along who decided to try the experiment over again. He found that, where settings of nine were in use, in no case did they last more than 600 days. But they now had several settings at work with eight retorts, similar to Mr. Hislop's and Mr. Chester's at Nottingham, where they had been working between 1100 and 1200 days. He saw them only a few weeks ago; and they would go on for a considerable time yet. There was a great deal in what Mr. Anderson and others had said about the damage done in letting furnaces up and down frequently; and this was a very important thing in all works. If they had a proper generator and regenerator, they could start them, and let them go on until the retorts were burnt out, as was being done at the South Metropolitan Company's works at East Greenwich. They had some beds there which had been working by machinery for upwards of 1200 days, and were still going on—they had never been let down; and this was one of the great advantages in connection with this system of firing. He would recommend them all to put in eight instead of nine retorts, by the same rule that six were better than seven, because they thereby secured a large combustion chamber where the ninth retort used to be, and also had a better distribution of heat throughout the setting. The cost must, of course, be taken into consideration. Mr. Chester gave the cost at Nottingham; but he knew of some settings which were being put up at the present time, where all the material would cost more than double the amount Mr. Chester gave as the outlay at Nottingham. Fire-brick was a very heavy material—1000 fire-bricks weighing about 3 tons 10 cwt.; and it so happened that, in some cases, one had to pay more for the carriage than the original cost of the material. Everyone must therefore take this into consideration before he could compare the cost of the various systems, and apply it to his own works and district.

Mr. CHESTER, in reply, said he was much indebted to the various members who had spoken so cordially on the question of gaseous firing. Mr. Valon seemed rather to regret that he (Mr. Chester) had not acknowledged sufficiently the work of the pioneers in introducing generative and regenerative firing into this country. He was pretty familiar with the work of all the gentlemen to whom he had referred, with the exception of the experiments made by Mr. Webber in 1878, which he had not heard of until that day. But, in addition to the names Mr. Valon had mentioned, he had in his paper acknowledged the work done by the gentlemen who took the prior steps towards the introduction of gaseous firing. There was Mr. George Anderson, for instance, who thirty or forty years ago was the pioneer with regard to fuel economy in connection with the heating of retorts. He was one of the early engineers who recognized the vast amount of waste continually taking place; and, with a view to utilizing a portion of this heat, he did, many years ago, arrange a combination of retorts of clay and iron, by which the remains of the heat were, as far as possible, utilized in connection with those iron retorts. Since the discussion commenced, he had had the opportunity of speaking to Mr. Anderson about the matter; and he told him that he still had in operation settings where there were two sets of fire-clay retorts, one on each side, and in the middle a setting of iron retorts which received heat from both settings. It was the experiments carried on between 1870 and 1880 which prepared the way, as it were, for the introduction of gaseous firing. While all credit was due to those gentlemen for their work about 1884, they must not lose sight of the work of the pioneers, who had dealt with the subject at a still earlier period; and he had endeavoured, in his paper, to recognize not only this, but the work of those who did so much to build up the system on independent lines when a large number of people were running over to Germany for all their information on the matter. There was no one whose work he acknowledged to a larger extent than Mr. Valon's; and he thought the Institute had, during the meeting, fitly recognized the

work he had done in connection with regenerative furnaces by awarding him the Birmingham Medal. He had been much interested by hearing of the experiments made by Mr. Webber so far back as 1878; and most of those present would remember the very admirable treatise which that gentleman had written on the principles of gaseous firing in the third volume of "King's Treatise on Coal Gas." On referring to it, they would find that it still remained as concise a statement of the principles of gaseous firing as could possibly be laid down; and he felt very grateful to Mr. Webber for it. Mr. Ritson could not understand how so long a period as 1100 days could be obtained in the working of retorts. He (Mr. Chester) could only say that all the statements in the paper were based upon actual results; there was nothing imaginary about them. The particular sets of regenerators referred to consisted of a bed of eight settings. They were lit up in the autumn of 1889, and let down in the spring of 1893; and during the whole of the time they were at work, they were never let down, but went on continuously for 1100 days, until they were pulled out altogether. There would have been no necessity to drop them then except for one thing, which he looked upon as the weak point in connection with retort-setting; and he was now taking steps to ascertain if that weak spot could not be strengthened. There would be no necessity to take the retorts out but for the fact that all the bolts of the mouthpieces had been burnt away, and the mouthpieces round the necks leaked badly. The interior of the settings might well have gone on another twelve months or two or three years. He might mention what he was doing to remedy this. It was a thing which had been in operation in many places before; and he believed it would have the effect of making the furnaces still more durable. He was going to abandon the retort-bolts altogether, attach a socket to the flange of the mouthpiece, and bolt this into the wall to the depth of 5 inches, and make it support itself, entirely dispensing with the use of the bolts—putting stays, of course, in front of the setting, and making the whole thing independent of the bolts. By this means, he expected to be able to carry the duration still further. The life of a setting of retorts depended, in the first place, on the character of the retorts and material used; and, secondly, on the disposition of the material in the setting. Round the combustion chamber it was absolutely essential to get hold of a material which could stand the very greatest amount of heat that could be developed there. Though he had tried every kind of material known to him, he had never come across one which would stand the intensest heat, except one, and that was a material which he always used for this purpose, and to which they were largely indebted for the long duration of the retorts. It only occupied a small portion of the setting. He put it round the producer crown, as well as all round the combustion chamber. During the whole 1100 days, there was no more harm done to the interior of the chamber than to the extent of taking $1\frac{1}{4}$ inches off the inside of the inner wing of the chamber arch. The sides and every part were as good as on the day the settings were lit up. He had built the combustion chamber arches with every kind of silica brick; but he only knew of one class of material that would satisfactorily stand the intense heat developed in this part of the setting. It was a Yorkshire material. Mr. Anderson had spoken of the durability of the various settings he had had in operation; and he (Mr. Chester) had also heard that it was not an uncommon experience with gas managers to get a very long lifetime out of a setting. This could, of course, be readily done when a portion of the setting was renewed each time it was let down. One time they renewed the middle retort; the next time they took out the tops or two of the sides; the next time, perhaps a bit of the other side. In the course of two or three years, therefore, which represented the life of the setting, the whole of the parts might have been renewed at least once. But this, to his mind, was not at all the proper way to consider the durability of the setting, unless at the same time they took into account the cost of these continuous renewals. Mr. Elliott said he did not see where the advantages of the grate system came in over the hearth beds of the regenerator fire. It was very simple. In the grate furnace the bars kept an even surface of material horizontal over the whole interior of the fire. Consequently, the air was free to pass up over the whole surface, and every part of it, through the fire, to form gaseous fuel. In the case of the hearth, the air could only come in contact with the fuel immediately exposed to it. It had not the same opportunity of dealing with it evenly throughout the whole of the fire. Mr. Irving thought that he (Mr. Chester) had taken an extreme case with regard to an ordinary setting, because he had put down the consumption of fuel as 28 lbs. of coke. This was not by any means an extreme figure, as had been confirmed by other speakers. But, on reading the paper, he had mentioned that the class of fuel dealt with throughout the whole of it was of the same character—a cannel coke containing about 12 per cent. of ash. This material yielded only a small quantity of coke per ton of coal; and what it did leave contained a considerable percentage of ash. Therefore, if they were to take as a basis of comparison the amount of combustible present, the percentage of fuel used would be materially reduced; it might come down to 10 lbs., or even less. But, rather than state it in pounds of carbon contained in the fuel, he preferred to keep the matter as practical as possible, and only alluded to it as the actual consumption of coke itself. Then with regard to the figures of the cost, Mr. Irving was under a little misapprehension when he referred to the cost of £50 per mouthpiece. It was really £50 per ton of coal carbonized per day. The actual cost per mouthpiece was £46; and this included everything incidental to the interior of the retort-house—arches, walls, main flue, ascension-pipe, hydraulic mains, weir-valves, relief-mains, and, in fact, everything. The hydraulic main and the weir-valve were of a special pattern devised by the President. There was no difficulty with regard to choking. He purposely kept out all questions of the analyses of the gases and of the coke. These were things which, though interesting from a theoretical point of view, were very misleading in many respects, because the proportion of these gases and the percentages of them varied continuously throughout the period from the time of filling up the fire until the time of filling up again. If they took them at any particular moment, and again a few minutes afterwards, they would get a different result; but, in regulating the work of the settings, the proportions of the primary and secondary air, at any rate, were arranged according to the average of the analyses of the gas taken from the settings. He arrived at these by a series of experiments; beginning with a fixed orifice, and gradually reducing this down until they had a small percentage of carbonic oxide going away with the waste gas. Directly this occurred, they began to have a considerable waste; and then they slipped back again, until they had 2 or 3 per cent. of oxygen in the waste gas. He found this was about the most practical way of determining what the orifice of the secondary air supply ought to be. In his own case, with a chimney having 16 beds connected with it, he found that the orifice which worked the best was that given by a circle 2 inches in diameter. He took a piece of sheet iron, cut a hole of this diameter, and by this means maintained fairly well the regularity of the gases leaving the setting. Directly the fire was filled, they obtained a large percentage of carbonic acid; but this gradually decreased in bulk until it dropped to about 4 or 5 per cent. of the producer gas. There was an equal rise in the other direction—beginning with a low percentage of carbonic oxide, and developing into a very large percentage at the time the furnace required to be filled up again. This was probably due to the ease with which the air passed the loose fuel when the fire was filled up, and the greater difficulty with which it went through as the fuel burnt lower and lower. The draught in the chimney was 8-10ths of an inch; but it was entirely controlled and regulated by the dampers, which were so closed as to leave only about 5, 6, or 7 square inches of area. Mr. Chew had mentioned a practical difficulty which he, and probably a great many other people also, had met with. It was, in fact, the short-circuiting or leakage of the gas from the producer into the regenerator flues, which brought about the collapse of at least two of the systems that he had alluded to. The original Siemens and Klönne furnaces were arranged with two descending waste-gas flues; a secondary air supply being placed between these two series of flues. Consequently, if there was any crack through the walls of the producer, short-circuiting immediately took place, because the draught was in a downward direction; and it made a short circuit to the chimney—leaving out the setting altogether. This difficulty was overcome at once by putting the air supply on the side of the furnace. The draught then being equal both in the

producer and in the secondary air flue, there could be no tendency to short-circuiting; both air and gas following the easiest route to the combustion chamber. If Mr. Chew would adopt this plan, he would, in all probability, succeed in preventing this short-circuiting.

Mr. CHEW said he had done this, but still had short-circuiting.

Mr. CHESTER said he did not know what the cause of it might be; but perhaps it was the way in which the bricks were put together. There might be a certain want of care in constructing the various walls. He did not suffer from this; and had never done so since he adopted the principle of putting the air channel between the descending gas and the furnace. Mr. Love had referred to the water-tube boiler. This was a matter which had his attention very early, on account of the considerable quantity of water necessary to supply the steam for the furnaces, if it was used in sufficient proportion to keep the fuel down in the form of ash instead of clinker. It used to cost 30s. or 35s. a week, with an ordinary boiler, to raise the necessary steam. He therefore devised a boiler which was inserted in the vertical flue, immediately before it went into the chimney; and the generation of steam went on pretty rapidly by the waste gas, without any attention at all. The fireman went up to the boiler every two hours, and pumped it full up to the top of the gauge-glass, and then left it. He went back again in two hours, and found the water had descended to the bottom of the gauge, and that it required a further supply. In this way, they evaporated from 1000 to 1100 gallons of water for the eight settings; and this supplied the necessary quantity of steam to enable them to take out the clinker from the fire, in an easily manipulated form, without any great trouble. Various references had been made to the depth and shallowness of the settings. The reason for having a deep setting was that it gave regularity of working. There was no necessity to watch it, feed it, and "tickle it up," or anything of that kind. A good deep fire worked itself, without attention; and if a man forgot to go in in the morning, as sometimes happened, it did not at all affect the furnace. They could go on for 46 or 48 hours without suffering any material drawback. Mr. Carr thought the least advantage in connection with gaseous firing was the savingof fuel. He took it that, if gaseous firing was to be a success at all, it must at least heat the retorts to the same degree as was obtained by ordinary settings. If it did not do this, it could not have made any headway at all in gas-works, because it was a vital matter that the quantity of gas should be got out of the coal; and if it could not be done as well by gaseous firing, then gaseous firing could not have made any progress. But it was very early recognized that, so far as heating was concerned, there was no reason to fear that it would not give better results than ordinary firing. If Mr. Carr would refer to the table towards the close of the paper, he would find, in the various items of cost—wear and tear, firemen's wages, and fuel—the item for fuel was very much larger than any of the other savings which could be made. Wear and tear charges were reduced from 5·66d. in the ordinary furnace to 1·55d. per ton of coal during the lifetime of the retorts; firemen's wages, which cost in the ordinary settings 5·77d., were reduced to 2d.; and the fuel, which in the ordinary settings cost 28d., was reduced to 12·50d. Consequently, the fuel item was, after all, that in which the most material saving could be effected. He might say, in conclusion, that any gentleman who was contemplating the remodelling of his retort-house might rest quite satisfied that he could now venture to sweep out the whole of his existing retorts, root and branch, begin *de novo*, and put in regenerator settings, with the utmost certainty that the savings would pay for the cost of the regenerators during a portion of their first lifetime, and that, directly after they had once been paid for out of revenue, they would continue to produce large profits to an extent that very few who had not experienced it could realize. With regard to the relative cost of the materials, he had taken them as delivered at the particular works. They would understand that, if works were more remote from fire-clay fields than Nottingham, they would naturally have to pay a higher price for materials.

Mr. TRAVERS said the whole ground had been so well covered already by Mr. Chester, that he would not occupy the time of the meeting by making any remarks on the discussion as it affected his paper.

DISCUSSION ON MR. W. CHEW'S PAPER ON "GAS AND ELECTRIC LIGHTING AT BLACKPOOL."

The PRESIDENT, in opening the discussion, remarked that he expected something very practical from Mr. Chew; but, of course, Blackpool was an exceptional place. He noticed that Mr. Chew seemed inclined to take a somewhat favourable view of electric lighting.

Mr. G. ANDERSON (London) said it would appear from the paper as if ventilation was all right when one had electricity; but, unless the ventilation were good, one was all wrong with gas. Mr. Sugg had told them that he and some friends were at one of the hotels where the electric light was in use, and they were doing some business before dinner, and he became very uncomfortable and drowsy from the closeness of the room—there being no ventilation. They then opened the doors between the two rooms, and lighted a gas-burner in the adjoining room. This set up a draught; and after that they were much more comfortable in the room where the electric light was. He knew of another case where a tradesman tried electricity; but, owing to want of movement in the air of the room, having no gas burning, the gloves on the top shelves all became spotted. Therefore there was not so much to be said against gas, if it only had fair play. Whether they employed gas or electricity, the rooms ought to be well ventilated. Even apart from its enormous price, electricity was not in all cases so good as gas.

Mr. J. STELFOX (Belfast) said he had listened with great pleasure to Mr. Chew's paper, and had made a few notes upon it. With regard to the point to which Mr. Anderson had referred, he always told people who represented that there could be no such thing as healthy rooms with gas, that, at most, the incandescent lamp could only prevent the vitiating of the atmosphere by gas. They could not carry away the vitiated products caused by the breath, which gas enabled them to do. He knew a house, belonging to an eminent doctor in Belfast, in which this was carried out to perfection. The doctor had flues in all the rooms, and used regenerative burners; and he prided himself in showing his friends how thoroughly ventilated the rooms were. Mr. Chew rather surprised him (Mr. Stelfox) in the last paragraph of the paper, because, after pretty well showing up the advantages of gas, he seemed all at once to come round, and give a forecast of what was to come in the way of electrical progress. At the same time, the main tendency of the paper was in favour of gas lighting. Some of Mr. Chew's figures with regard to the cost of electric lighting, in fact, rather startled him. He spoke of gas people having to part with a "slice" of their loaf; but if the slice only amounted to 1 million out of 150 million cubic feet, they could well spare it.

Mr. T. H. MARTIN (New Barnet) said he should like to add his thanks to Mr. Chew for his very valuable paper. He (Mr. Martin) had not had any experience in connection with the generation of electricity; but he knew something of the public lighting of the town of Barnet. It was represented by an eminent electrical engineer that electricity would cost about 5d. per unit, or equal to gas at 4s. 2d. per 1000 cubic feet, as he understood the electricians told them that 10 units were equal to 1000 cubic feet of gas. They had now from Mr. Chew a correct record—the highest he had seen—of the cost of the lighting, including the plant at Blackpool, which was nearly equal to gas at 7s. 6d. per 1000 cubic feet. The installation at Barnet was conducted by Mr. Joel; and the incandescent lamps were of (so-called) 32-candle power. After three years' experience, the Local Board had returned to gas lighting, and for some time subsequently were engaged in litigation with their electric lighting contractor, which resulted in their defeat—costing the ratepayers upwards of £2000. This session a Provisional Order had been obtained by the Barnet Local Board; and two eminent electricians—Professors Robinson and Pearce—advised them they could light the town at a considerably less cost per unit than that given by Mr. Chew. How they could do so, he (Mr. Martin) did not see. Mr. Chew's town was much nearer the coal-fields than Barnet. This would be a great consideration, as without power electricity could not be produced. With reference to the light, no one could find fault with it. They all admired it; and their duty was to compete with it. With regard to ventilation, he did not know whether any of those who were present at the reception on the previous night noticed the heat.

The hall was beautifully lighted by electricity; but there was a very great want of ventilation, which they would have had if gas had been burning.

Mr. C. Stafford Ellery said he was interested in a town where they were favoured with the presence of the electric light. His opinion was that it was a competitor which suppliers of gas had to face. He was not at all sure that they had suffered as some supposed. There were various points which required clearing up. A great many had certainly been disposed of in the admirable paper before them; but could Mr. Chew give them an idea not only of the life of the lamps, but of their efficiency? He (Mr. Ellery) believed, as months—perhaps weeks—passed on, the efficiency of the lamps was a very uncertain quantity. This was a point on which some more information would be extremely interesting. One other matter was that gas companies were at a much greater disadvantage in towns where the local authorities had possession of the electric light works, and subsidized the undertaking from the rates. Where a company supplied the light, it was different. They were reluctant to publish their balance-sheets. When a corporation took over the works and sold current at less than cost price, the ratepayers would have to assist those who were carrying on this unfair competition. If they produced electricity at 7d. or 8d. per unit, and sold it at 6d., somebody must pay for it; and he took it that the ratepayers would have to do so. He should therefore like to see, as far as possible, the undertakings in the hands of companies, or, if they were public property, that they were carried on so as to be self-supporting.

Mr. G. B. Irons (Gosport) said he had been much struck by the great improvement in electricity at the present time. He found that the inauguration of electric lighting in Blackpool was in August, 1893; and a system had just been introduced in Portsmouth on similar lines. In a very short time, under the leadership of Professor Garnett—nephew of one of their former Presidents—and Mr. Ferranti; they had introduced some very great improvements. One was in the method of driving. Instead of having cotton ropes, the dynamo was coupled direct to the engine; and in place of a fly-wheel only to the engine, the fly-wheel was made part of the dynamo. The system was similar to that of Mr. Chew. There were separate wires for arc and for incandescent lights; and they adopted the transformer system. This sent out the current at 2000 volts; and every consumer's premises had a transformer, reducing it to 200 volts, instead of 100 volts, as with Mr. Chew. At the time of the inauguration of the system, the Lord Mayor of Dublin and the members of the Corporation were invited to assist; but it turned out to be a very wet night. A constable stepped on the cover of one of the transformers, and received rather a sharp shock. He found his legs drawn together, and his arms jerked up. The wet evening would, no doubt, tend to show leakage more than if the weather had been dry. He would ask Mr. Chew if he could mention any precautions which could be taken to avoid such shocks. He might mention that he first saw the electric arc light as long ago as 1847. It was displayed at the top of the National Gallery, and the light was projected down to Whitehall; but to do this a very large quantity of cells were employed. Of course, the discovery of the dynamo had completely altered the conditions; and great strides had been made during the last ten years.

Alderman Miles (Bolton) said he should not have intervened in the discussion, but for the fact that at the present time they were engaged in erecting electric light works at Bolton. They were much indebted to Mr. Chew for his admirable paper; for there was no one in the room more capable of speaking with authority on this subject. He wished to ask him particularly with regard to the motive power to be used in central stations. He thought it would be wise on the part of gas engineers not to exhibit any jealousy with regard to the new light; and he feared there was some tendency that way. He had heard from one gentleman that he was very much exercised in his mind as to the cost of production, and where the apparent loss would be made up—whether it would not come out of the ratepayers' pockets. They ought not to expect that a new industry, in the first, second, or third year, would become a paying concern. Their own gas-works would not pay during the first or second year of their existence; but when they came to get the matter fairly developed, as was already seen at Bradford, the thing would no doubt be a success. At Bolton he thought they had taken the right course. The gas-works belonged to the Corporation; and they gave the electrical work to the Gas Committee, who were managing both undertakings; and he thought they would do so without any jealousy between the two departments. Being Chairman of these two Committees, he told them it was their duty—and they at once accepted it—to supply the public with the kind of light they wished for. If they asked for the electric light, and were determined to have it, they should have it. Electricity would have fair play in Bolton. They hoped to furnish a supply in August next; but they did not expect to make a profit the first, second, or third year. Whatever electricity did, however, would have to be done on its own responsibility; and so far as he was concerned, it should not be subsidized by the gas profits. If it could not stand on its own basis at 5d. or 6d. per unit, those who wanted it would have to pay such a price as would enable the works to pay. One of the great disappointments he had noticed about electricity was that, up to now, there seemed to be no disposition on the part of gentlemen who erected these works to use the admirable gas-engines which were now so common. He was extremely desirous of doing this in their own works; and, of course, the Gas Committee were anxious to supply gas for motive power if it could be made available. But he was sorry to say that, with all their inquiries, up to then they had not succeeded in ascertaining that there was a really suitable gas-engine for this particular work. He thought makers of these motors ought to put themselves in a position to supply such an article, because he was quite sure that, in many respects, there was no appliance so suitable for the purpose. He should like to know if Mr. Chew had given attention to this matter.

Mr. D. Bruce Peebles said he had listened with great pleasure to the paper, and was also very much pleased with the tone of the discussion so far. With regard to Mr. Anderson's statement of Mr. Sugg's recorded experience in the hotel, he remembered very well the reading of that paper, and there was a good deal of hilarity and some joking at the expense of electricity. He said then that no good general ever despised an enemy. They were feeling more and more every day that electricity was getting into a groove which it would never be put out of again. In Edinburgh they were now having the streets opened for the introduction of wires. In Glasgow, Aberdeen, and Dundee, electric lighting was in operation; and one particular thing he wished to bring before the meeting was that, at Coatbridge, gas-engines were being employed at a central station for electric lighting. He knew the Engineer very well, and discussed with him the subject of steam *versus* gas engines; and, after a good deal of thought, he decided to use gas-engines. In Coatbridge, therefore, a crucial test would be made of their applicability to supply electric lighting on a large scale. Another point in connection with Glasgow was this: They had abandoned the extension of the supply of electricity for street lighting, and were putting up several incandescent gas-lamps; and he thought gas had a great future before it in connection with improved methods of lighting. If the illuminating power of gas could be reduced, and its price cheapened, there would be a greatly increased business for gas companies in the supply of gas for lighting purposes, fires, cooking, and engines.

The President remarked that Mr. Stelfox had informed him that Professor Kennedy had recommended that gas-engines should be used at Belfast for the whole of the electrical plant; and the order had already been given for them. As time was short, he would only thank Mr. Chew for his kindness in taking so much trouble to compare the practical working of gas and electricity at Blackpool. He knew of no higher authority on the subject than Mr. Chew. He had been the Electrical Engineer to the Corporation for thirteen or fourteen years; and, knowing how careful both he and his father were in working out figures, he was quite sure that what he had put before them could be accepted with perfect confidence. He was glad to find that Alderman Miles, the Chairman of the Gas Department at Bolton, had made it clear that the cost of producing and maintaining the electrical department there would have to be defrayed by those who used electricity. Being a consumer of gas in Manchester, and being a ratepayer, he (the President) certainly did think he ought not to have to pay for the luxuries of other people. If they would allow each tub to stand on its own bottom, he had

no objection whatever; and in this way the relative merits and cost of the different systems would, in the course of time, show themselves. He hoped that on some future occasion Alderman Miles would give them the results of his experience at Bolton.

Mr. CHEW, in reply, said, with reference to ventilation, electricity was not so good an agent as gas. The whole advantage of electricity was that it did not assist in polluting the already polluted atmosphere of a room. Gas helped to cause a circulation; and electricity did not accomplish this. Of course, in a room with no ventilation, the air become stagnant; but with regard to the reception on the previous evening, he must say he heard several remarks as to how pleasant and cool the hall was. As that was the first gathering of the kind he had attended, he could not judge by comparison. Mr. Stelfox had stated that he was pleased at finding such a very small slice of the loaf was being cut off. He (Mr. Chew) was satisfied, so far, with a little slice; but he did not want the slice to get much bigger. Mr. Martin had complained of the cost of the lighting at Barnet; but they need not complain, because they had put the price sufficiently high for electricity to pay for itself. The tendency was to keep the figure very low. Every electrician wanted to excel the others; and gentlemen would be surprised at the extent to which economy was caried. In the revenue account, the working cost was brought down to the very lowest point. As an instance of the manner in which details were thoroughly analyzed, he knew of one station using a 4 ft. 6 in. long daily record sheet so as to give the cost of every item. He did not know if any gas managers had daily sheets of their cost worked out in such infinitesimal detail. They worked everything so fine that they could barely afford anything beyond the actual necessities of the day. Electricians had to work out every point in small fractions of a penny, as their basis of cost; whereas gas managers had a basis of cost amounting to ten times that of electricians. Mr. Ellery wished to know the effective life of the lamps. This could hardly be settled. It was a side which electricians did not like to show at present; but experiments were being made at Chicago of the burning during a great many hours, and testing the life of the lamps. He expected that before long a full report would be published, which he was looking forward to as settling the point Mr. Ellery had mentioned. From the *Engineer* for the 8th of June, he had obtained a return as to tests made of the consumption of current by incandescent lamps, the illuminating power of which at the commencement was 16 candles. In one of the experiments, the number of lamps tested was 23; the average life, 500 hours; the average illuminating power at the end of the test, 11 candles; and the average illuminating power throughout, 13½ candles. The next test was made with 19 lamps. Their life was 450 hours; the average illuminating power at the end of the experiment being 10·8 candles, and during the whole period 13¼ candles. With 30 other lamps from other makers, the average life was 113 hours; and the illuminating power was 16 candles right through. With another experiment, 2 lamps only were tested. They had 785 hours' life; the average illuminating power at the end being 11 candles, and 13¼ candles right through. With regard to the shock, such things were very useful to the electrical engineer, as indicating where there was a leak, in the same way as a leakage of gas showed itself by the smell. Alderman Miles had mentioned that he was in favour of a dual supply; and he quite agreed with him. As people became richer and more enlightened, they wanted a little more luxury; but he also agreed that they should pay for it what it cost. He had said in his paper that in most towns a system of electricity could be applied with advantage. With respect to the use of gas-engines for driving the machinery, this had been a very vexed question. At present, they hardly liked to face the subject of gas-engines; and why should not Bolton take the lead, and say they would have a gas-engine in order to show what could be done? They were all waiting for someone else to take the initiative; and no one could do it better than such a Corporation as that of Bolton—a strong and wealthy Corporation with a well-paying gas undertaking in a flourishing condition. They were the people to make experiments with gas-engines; and he should be very pleased if they would only try one of their machines on such an engine, and let him know the result. He found that at Coatbridge the experiment was being tried of driving the dynamos by means of a gas-engine, each engine indicating 120-horse power; but, unfortunately, it was Dowson gas, not illuminating gas. Still, if they could get a gas-engine to work satisfactorily with Dowson gas, no doubt they could do it equally well with illuminating gas. If they could carry out this 120-horse power work satisfactorily, it meant further orders hereafter, for the makers of both producer and illuminating gas. There were plenty of places where gas-engines could be used for electric lighting on a small scale. He had had in Blackpool to do with an establishment using five 60-horse power gas-engines for electric lighting; and they were competing with the steam-engines belonging to the central electric lighting station. At Fleetwood, near Blackpool, the Commissioners, being a go-ahead class of people, were determined to put down a gas-engine the same as at Coatbridge; and in another twelve months, he hoped to have the figures. The great doubt was about the steadiness of the engine. He had seen a small gas-engine at work in a private installation; and every stroke of the engine caused a fluctuation (hardly perceptible) of the light. If the improved types under trial would maintain their steadiness, there would be a very great demand for them, as gas engineers might hire out complete installations, using town gas, if necessity should arise. Another speaker had referred to the Welsbach light; and there was no doubt this had come as a great boon at the present time. If it were introduced, there was no doubt they would gain many customers for gas who would otherwise take electricity. At Blackpool, many places were fitted up with the light. It was introduced by one or two people; and it was so satisfactory that a great many others followed. In fact, one establishment had credit for being lit with the electric light; but, in fact, they had only one incandescent electric lamp, the rest of the premises being lighted by incandescent gas-lamps. The tradesmen, however, were taking electric light for their shop windows, because it displayed the goods to great advantage, and rather tended to stop the steaming of the windows, which was an advantage. But inside the shops they wanted something warm to keep the goods and air dry, and cause a circulation of air, which stagnated with electricity. He therefore thought there was no fear of gas being ousted entirely.

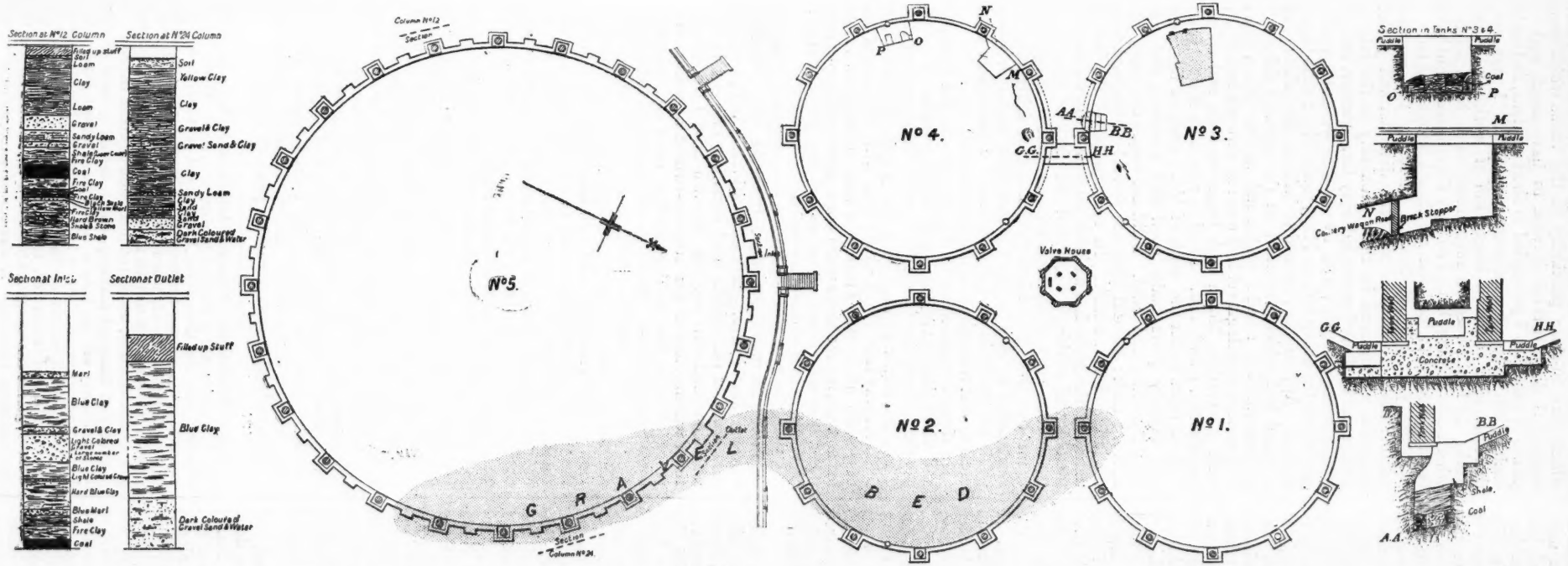
MY EXPERIENCES WITH SOME LEAKY GAS-HOLDER TANKS.

By J. CHADWICK, of Oldham.

Probably most of us, at some time or other, have had experiences of various sorts. Things do not always move so smoothly as one could wish; difficulties present themselves, and accidents happen, often from unforeseen causes, and entirely beyond our control. Sometimes it may be that cases occur within one's knowledge which may be of advantage, or of interest to others, if the circumstances and surroundings were made known.

For a long time, on and off, I have had a considerable amount of trouble with leaky gasholder tanks. Many gentlemen previously to myself have had similar troubles; and possibly many others will yet have to try their hand at repairing leaky gasholder tanks. Difficulties of this character, and means taken to remedy such defects, have been the subjects of papers which have been read before this Institute by gentlemen who have been so fortunate, or unfortunate (as the case may be) as to have had this class of work fall to their lot. I therefore do not claim to bring before you a new subject; but it may be that the reasons for, and the cause of these particular tanks leaking, differ somewhat from others, and so I have ventured to think that my own experiences might not be altogether uninteresting.

I feel that, to enable you to understand what I wish to convey to your minds, I must go back somewhat in the history of these tanks. In the years 1868-70, there were four gasholder tanks constructed at the works to which I refer, in close proximity to each other, as shown on the accompanying diagram, Nos. 1, 2, 3, and 4. The tanks are each 102 feet in diameter and 30 feet deep, built of bricks, with stone footings, ring-courses, and copings. They are of the kind known as puddled tanks; the walls and bottoms being backed and covered with clay puddle. In the year 1870, gasholders on the telescopic principle (each holder being in two lifts) were erected in the tanks marked No. 1



and No. 2 on the diagram; and in the following year the two gasholders were put into use, and continued to work all right up to the year 1889.

In the year 1879, an additional gasholder, similar to those already mentioned, was erected in the tank marked No. 3 on the diagram; and it was constantly in use from this time up to October, 1884. Another gasholder was erected in the tank marked No. 4 on the diagram, and was completed in the month of October, 1884. When this gasholder was about being completed, the water was turned into the tank, and allowed to run in gradually until it was 26 feet deep, or only 4 feet short of being full. It then showed signs of losing water, which ran slowly away for some days; and eventually No. 3 tank (which had been in constant use for five years) showed signs of losing water also. As soon as the water in No. 3 tank began to lower, it commenced to rise in No. 4 tank; and ultimately both tanks attained the same level. There was therefore not only an absolute leakage, but also a connection between the two tanks. I then fixed a pump in No. 3 tank; and by working it in this position, succeeded in emptying the water from both tanks. Upon examining the tanks, I found a hole in the bottom of No. 3, through the puddle. It was about 4 feet up the slope of the mound, and near to No. 4 tank. The bottom of No. 4 tank was very bad in several places. There was a hole near the outlet-pipe, one near No. 3 tank, and several others where the water had apparently run away. It had now got into November; and I was anxious to get one of the holders into working order for the winter months, if possible (which, however, I was unable to do), so after some preliminary preparations, I began the repairs in No. 3 tank, as this seemed to require the least work.

An excavation was made near the hole before mentioned, which took a slanting direction, and was cut through 2 feet of puddle, and about 7 feet of good, hard, stiff clay. The hole was in size and appearance something like a rabbit run. The ground was firm and solid, and seemed good enough to have stood any pressure that was put upon it. The excavations then reached the shale, the coal measures, and old coal workings. After having found a sound bottom, the excavation was made good with concrete. I may parenthetically observe that some of the middle coal measures crop out in this locality, and that others are found at no great depth below the surface. These mines were worked in this neighbourhood many years ago; and I have no doubt in my own mind but that the hole found in the bottom of No. 3 tank was in the first instance started and made by rats, burrowing upwards from the old coal workings. I found that considerable repairs were necessary in No. 4 tank, as there were several places which showed indications of weakness. A considerable portion of the tank wall required undersetting; and the rest-stones and outlet-pipes all wanted taking out and refixing.

Both lifts of the holder were therefore raised about 3 feet, and packed up with timber from the rest-stones and centre pier. The rest-stones were taken out one at a time, the floor made good, and the stones replaced. The ground was excavated all round the interior of the tank wall, and filled in with concrete. This excavation varied in depth from about 5 feet to 11 feet below the footing-stones of the tank wall; and in many places the wall had to be underset, and filled up with concrete. At point N, as indicated on the diagram, the excavation reached 17 feet below the footing-stones, and was in an old heading,

or waggon road, of the disused coal workings. In some places, timber was found which had evidently been used as prop wood by the miners, and pillars of coal which had apparently been left in to support the roof. The coal had evidently been worked out here, and partly filled in with dirt, smudge, and coal rubbish; and in some places the puddle of the tank was placed almost immediately on this material. I endeavoured to obtain a hard bottom, to start the concrete from; and mostly went down to the fire-clay. There was a serious defect under the outlet-pipes, which had to be taken out; and here we came upon the old coal workings and waggon road again, with pillars of coal left in, and filled in with old coal rubbish as before. Here, too, we found some of the old prop wood left in by the workmen, probably many years before. There were also several holes in the ground, which I am strongly of opinion had been made by rats. This place was also made good with concrete; and the walls were underset with similar material. The outlet-pipes were then refixed. The inlet-pipes had only slightly given way; and this was rectified without their removal. On the diagram you will notice two or three sections showing the position and state of the old coal workings, &c., at the points indicated.

After having, as I thought, made all good, No. 3 tank was filled with water during the latter part of April, 1885; and the holder was put to work on the 7th of May following—No. 4 tank having only 2 feet of water in it at this time. On the evening of May 9, however, the water began to run out of No. 3 tank, finding its way into No. 4 tank; and it ran so rapidly that the water was lowering at the rate of one foot per hour. I went inside No. 4 tank; and found the water boiling up like a whirlpool through the bottom. I put No. 3 holder out of use as soon as possible; and on the following day, the water in both tanks had attained the same level—viz., 13 feet below the coping-stone—which was maintained for several days. It therefore appeared that the worst fault previously existing—namely, the running of the water absolutely away—had been remedied. There, however, was still a fault between the two tanks; and it appeared to be at about the point indicated by the water coming into No. 4 from No. 3 tank. I therefore determined to dig down between the two tanks at this point.

The water was pumped out of the tanks again (by fixing the pump in No. 3 tank only); and then an excavation was made between the tanks to a depth of 35 feet. I found the puddle washed away from under both walls; and the ground was full of water, which drained out whilst the excavation was open. The earth and the puddle were broken and disturbed for about 8 feet above the bottom of the tank walls; and it was possible for a person to have crawled from one to the other underneath the bottom of the walls. The walls were underset with concrete entirely through the whole thickness; and a concrete stay was carried across the excavation. The puddle and excavation were then made good. On examining the floors of the tanks, I did not find anything wrong with No. 4 except just at the point where the water came in from No. 3, and which was remedied by concrete; but the floor of No. 3 tank was very much disturbed and broken. It appeared as if it had settled down somewhat; and I attributed it to the water getting into the loose material, and washing part away with it. The tank wall wanted undersetting for some distance, which was done; and the excavations went through the old coal workings, to get to a hard foundation. Several of the rest-stones had slipped, and slid from their original position; and these had to be re-set. The whole of the floor of this tank had to be re-puddled, and several places made good with concrete.

In the summer of 1885, I had the repairs completed, and began to run the water into the tanks. This was done gradually, and at intervals. It turned out that No. 3 tank was perfectly water-tight; but there was a slight leakage from No. 4, which did not show until the tank got half full. I then put the holder in No. 3 tank to work once more; and left No. 4 tank half full of water during the winter. The leakage was very small; so during the following summer I filled the tank, and put the holder to work in the autumn of 1886. Both tanks and holders have worked continuously since; and have remained right.

It may seem to many of you that I was a long time in making these repairs; and I am free to admit that this was so. But seeing the nature of the ground, and considering that my holder room at the time was very limited, and in view of the fact of having to underset the walls, which were in close proximity to the tanks which were working, I did not think it wise to have much work in pieces at once; so I proceeded in short sections, and made each good before I commenced another. I was not, therefore, able to put a large staff of workmen on the work. If I had been so unfortunate as to have set the other tanks leaking, both I and my Committee might have become more notorious than we should have cared for.

In the year 1889, it became necessary to construct another tank; and one of 202 feet diameter and 30 feet deep was commenced in close proximity to the others. Before the work had proceeded very far, however, the old trouble came on again; and by the time we had got half-way down the sump hole in No. 5 tank, No. 2 tank began to leak. Appearances seemed to indicate the existence of a gravel bed, which extended on the easterly side, and underneath Nos. 1 and 2 tanks, and up into No. 5 tank; and as soon as this gravel bed was cut through into No. 5 tank excavation, No. 2 tank began to leak, and subsequently No. 1 tank also. I had to take a lot of this gravel bed out from under the walls of No. 2 tank on the north and easterly parts, make good with concrete, and stop back the water and sand. I did not empty the water out of No. 1 tank; but did what was possible to that tank from the inside of No. 2 tank. In consequence of the broken nature of the ground, and knowing how close we were to the old coal workings, I covered the floor of this No. 5 tank with a layer of concrete 6 inches thick. It appears to me that this gravel bed (which seems fairly large) is surrounded by clay or other impervious material, which holds the water in it; for Nos. 1 and 2 tanks were tight until we cut through it in the excavations.

In 1891, the gasholder in No. 5 tank was put to work; and all of them have continued working since. I cannot say that the whole of the tanks are absolutely water-tight. There is a slight leakage from No. 5 tank, which I think finds its way into No. 2 tank; but with this exception, they seem all right. There has been no increase in this leakage during the three years it has been working—if anything, it is rather less. The level of No. 5 tank is 12 feet higher than that of the other tanks.

The ground in this locality is of a somewhat broken character, as may be noticed from the two geological sections taken in No. 5 tank excavations. As I previously said, some of the middle coal measures crop out in this neighbourhood—in fact, on our own land I have found them within 4 feet of the surface—whilst at a short distance away to the north-east, the lower coal measures come to the surface. There are also numerous faults in the strata in this district. Within 200 yards of the spot referred to, some 8 or 10 years ago, there was exposed to view in close proximity to the original surface of the ground the remains of a veritable fossil forest, with numerous tree trunks of considerable size on every hand. This was an unique sight, and brought a good number of persons from various parts of the kingdom to see it, including many gentlemen of high scientific attainments.

I need scarcely say to a meeting of this character, how necessary it is for great care to be exercised in selecting suitable sites for works of this description. If good, hard, and stable ground can be got, well and good; but if not, and we have to put up with a site of a somewhat questionable nature, it is desirable to counteract as far as possible any faults in the ground, by works of a suitable constructive character, even if the expense should be more than one anticipates. Gentlemen who have had experiences of repairing gasholder tanks, will, I think, agree with me that it is a disagreeable, nasty, awkward, sometimes dangerous, and always expensive piece of work.

Eastern Counties Gas Managers' Association.—We learn from the Hon. Secretary of this Association (Mr. Harry Wimhurst, of Sleaford) that the Committee have found it desirable to alter the date of the autumn meeting from Thursday, the 13th, to the 6th of September next, when the members who attend the meeting at Yarmouth will be able to visit a gas, electrical, and industrial exhibition, which terminates on or about the 8th.

Society of Chemical Industry.—The annual general meeting of this Society will be held in the Queen Street Hall, Edinburgh, to-morrow and the two following days. The business on the first day will consist of the presentation of the reports of the Council and Treasurer, the election of office-bearers, the delivery of the Inaugural Address, and the transaction of the miscellaneous business. A number of interesting visits and excursions have been arranged.

ESSAYS, COMMENTARIES, AND REVIEWS.

GAS AND WATER COMPANIES IN THE STOCK MARKET.

(For Stock and Share List, see p. 157.)

THE week just concluded has not been a favourable time on the Stock Exchange. The general tendency was dull and flat; and the chief factors influencing prices were adverse. Foremost among them was the strike in America, which assumed alarming proportions in the earlier part of the week. Prices, however, were not so much affected as they might have been; and the strong undercurrent of expectation that the trouble could not last long was amply justified by the close. Home rails, indeed, were worse than American. Then there was a good bit of apprehension regarding the settlement; and, though there has been no attendant catastrophe thus far, perhaps we are not quite "out of the wood" yet. Choice investment stocks have meanwhile steadily progressed; and Consols are dearer than ever. The Money Market remains *in statu quo;* there being any quantity which cannot find employment. The Gas Market, on the whole, has been quieter; but it remains just as strong, although advances in value are fewer and less considerable than they were in the week before. In Gaslights, "A" has been moderately and steadily dealt in at middle figures; never ranging much above or below 242. Transactions in the other issues were very limited; but excellent prices were readily obtained. Little was done in South Metropolitans, except in "C;" and that rose a point. But "A" and "B" changed hands once or twice at high figures; and sellers of the debentures are asking as much *ex div.* as they did *cum div.* Commercials were hardly marked at all. There was scarcely a transaction in Suburbans and Provincials; but Brentford and Bromley rose in value, while recent sales of Tottenham and Edmonton at the Mart justify a higher quotation, although no business was done in the market. Continentals keep very firm; Union and European commanding top figures, while Imperial has advanced by 3. Favourable movements among the rest are improvements to a slight degree in Monte Video and Oriental. The Water Companies have been quiet; there being some days without a single transaction marked in them. But they are all very strong; and several have made nice advances in value.

The daily operations were: Gas opened unchanged on Monday, and closed, after a rather quiet day, without any alteration. Business was not any more brisk on Tuesday; but quotations began to advance. Imperial Continental moved up 2; both Bromley issues, ½ each; and Oriental, ¼. In Water, Chelsea and West Middlesex were 1 better. Wednesday was another quiet day; and again quotations underwent no variation. Thursday's transactions were limited to Gaslights and Imperial Continental at medium prices, without alteration. In Water, an advance of 2 each was made by Chelsea, Lambeth, and Southwark ordinary. Friday was somewhat more active; and a further improvement of 1 was made in Imperial Continental. Southwark ordinary rose 1 more; and New River advanced 2. Saturday was more than usually active. Brentford old gained 2; South Metropolitan "C," 1; Monte Video, ½.

ELECTRIC LIGHTING MEMORANDA.

The Illuminating Power of Electric Arc Lamps—Effective Street Lighting by Arc Lamps—Electric and Gas Combinations.

THE subject of the rating of the illuminating power of all kinds of electric lamps is a delicate one to discuss with electricians, notwithstanding the satisfactory readiness which the more reputable followers of the electric lighting industry have shown of late years to drop such fanciful descriptions as that of the "2000-candle power" arc lamp, and to rate such lamps according to the amount of energy they consume. Driven from the common street arc lamp, those electricians who still cherish a belief in the attractiveness of big figures in respect of candle power have fallen back upon the search-light and lighthouse forms of the arc lamp, and still astonish the world with the results of mixing up the law of radiation with the effect of optical focussing and projecting appliances. One of the latest cases in point is that of the French search-light which was exhibited at the Chicago Exhibition, and is now erected at Sandy Hook. To gratify the American taste for big things, this light is rated at no less than 194 million candle power. It is almost superfluous to add that it is the "biggest show on earth of the kind." An electrical contemporary inquires, with a touch of scorn, how much higher than this the rating of search-lights will be carried. It is impossible to say; but it is probable that if any city of the American Union should be seized with a desire to "go one better" than New York in the matter of search-lights, there will be no difficulty in satisfying the demand. Meanwhile, it may be recommended to those who believe in these exaggerated candle powers as attributed to search-lights, to ask themselves how such figures can be reconciled with the constantly accumulating evidence of the inability of the electric arc light to penetrate fogs. Quite recently the powerful arc lamp of the May Island lighthouse, which cost £60,000, and is credited with visibility in clear weather at a distance of 20 miles, was powerless to warn off a vessel which struck the rocks only 500 yards away. A fisherman, who gave evidence at the Board of Trade inquiry into the loss of the vessel, stated that when he was about a mile from the island he could not see the light, although he could see the oil-light on the Fifeshire coast at a distance of 2½ miles.

The Americans have at last discovered the true principle of successful electric arc street lighting, which is to have well-fitted, well-served lamps, and plenty of them. In an American technical publication, it is stated as a probability that Fifth Avenue, New York, is now the finest example of an electrically illuminated thoroughfare in the world. This is asserted to be the result of having at each cross-street corner an ornamental iron post carrying two low-tension arc lamps of tasteful design, fed from the ordinary house-service mains of the Edison Illuminating Company, while another similar post is placed in the centre of each block; making in all 80 lamps per mile. This, then, is the scale upon which it is necessary to employ arc lamps for street lighting in order to produce an effect that can be truthfully described as "most artistic, brilliant, and beautiful." We can, however, recall a period when it was considered the "advanced" thing to expend similar adjectives in describing the effect of stringing two or three Brush arc lamps per mile along a thoroughfare rendered hideous by day by unsightly wooden lamp-posts with their gallows-like aboriginal lamp-fittings. We should never think of objecting to 80 arc lamps per mile, if any solvent highway authority in Engiand were to go in for this scale of lighting. Even this, however, does not exhaust the possibilities of arc lighting, when money is no object. Not a hundred yards from the Ludgate Hill Station of the London, Chatham, and Dover Railway, there may be discovered, by the curious in such matters, a narrow, winding City thoroughfare, from which during business hours darkness is banished by an array of arc lamps spaced about 20 to 30 feet apart. Of course, the place is a "market;" but it is a good example of the capabilities of the arc lamp when employed to create an effect regardless of cost.

In default of anything new and at the same time good for any practical purpose in the electrical world, one of our electrical contemporaries has been making fun of Mr. Robert Hammond's recent tramway paper, read before the Incorporated Association of Municipal and County Engineers, which was an artless attempt to show that something might be done by combining central station electric lighting with electrical tramway working. Briefly stated, Mr. Hammond has had the brilliant idea that it would be a very nice way of increasing the day load of an electric lighting station to use the current to run cars during the day, and then, when the lighting business comes on in the evening, to disconnect the tramways, and hitch on horses to do the rest of the haulage work for the night. By this plan the load curve at the power-house would be beautifully levelled up; while, of course, it would not matter if the horses had to be kept in reserve, eating their heads off during the day. Our contemporary refers the author of this ingenious scheme to another plan originating in the States, wherein a whole central station is put on board the car—a compressed store of gas, a gas-engine, a dynamo and accumulator, and an electro-motor. The gas is to supply the gas-engine, which is to drive the dynamo, which is to charge the accumulator, which is to work the electro-motor, which is to drive the tram-car. There is one thing lacking to make this perfect—there ought also to be a gas-works on board; and even then it might be better to take a coal mine too, while the inventor is about it. As our contemporary remarks, some people believe there is a virtue in combining a variety of appliances. Hence the patent offices of the world are largely supported by enthusiasts who think a claw-hammer improved if it has a musical box concealed inside the handle, and can also be used on emergency for saving life at sea. So far as we are aware, the most favoured combination of the gas and electrical services is of a financial character, and is employed by municipalities owning undertakings of both kinds to enable the one to be supported by the profits of the other.

THE LABOUR COMMISSION REPORT.

IN the opinion of some, the most important part of the Labour Commission report would be the recommendations with which the majority of the Commissioners conclude their review of the facts, opinions, and arguments which were, in various ways, brought before them; inasmuch as these conclusions may be regarded as a concise expression of the effect produced upon the minds of a number of representative Englishmen by the most earnest, patient, and prolonged study of the industrial problem that has ever been undertaken at the instigation of Government. The first point to which the Commissioners turned their thoughts was as to whether anything can be done, by way of legislation, to promote the better settlement of disputes between employers and workmen. They found a variety of mutual organizations in existence, having for their avowed or ultimate object the prevention and settlement of trade disputes; and they formed the opinion that the effect of these trade and district boards is highly beneficial in averting conflicts, although they are as yet far from covering the whole field of industry. They were thus led to consider whether it would be possible, by any legislation, either to increase the

efficiency of these institutions or their number, or to supplement them by the creation, under Act of Parliament, of boards of a similar character.

In the first place, the Commissioners discussed the question whether it would be expedient to establish, or to give to town and county councils power to establish, industrial tribunals throughout the country, with legal powers to hear cases arising out of existing and implied agreements, or depending upon the interpretation of trade customs, and to make enforceable decisions. Upon the whole, they did not find themselves able to recommend the systematic and general establishment of special industrial tribunals (in addition to the existing legal methods), for deciding questions arising upon existing agreements. They think, however, that, though it would be unwise to institute any general system of industrial tribunals, there might be some advantage in an experiment in this direction, of a tentative and permissive character. It is admitted that the power to initiate the institution of new industrial tribunals might not at first be largely used by local authorities, if they possessed it; but it is considered that, in some parts of the country, there does exist a want that might be met in this way. Before anything of the kind could be done, the ground would have to be cleared by the repeal of some existing statutes which have remained a dead letter.

A proposal has been made for the establishment by Act of Parliament of district boards of conciliation and arbitration, the chief object of which would be to bring about the settlement of questions relating to future agreements. The Commissioners, however, declare their hope and belief that the present rapid extension of voluntary boards will continue, until they cover a much larger part of the whole field of industry than they do at present. This development seems to the Commissioners to be at present the chief matter of importance; and it has the advantage over any systematic establishment of local boards, of greater freedom of experiment and adaptation to special and varying circumstances. If at some future time the success of these voluntary boards throughout the country should become well assured, and if any success should attend the experiment previously suggested of giving to local authorities the power of initiating the formation of industrial tribunals, it may be found expedient to confer larger powers upon such organizations.

The Commissioners think that, although the direct intervention of the Board of Trade, as a Government Department, in industrial affairs is to be deprecated, much good might be done by the collection and publication of information upon which both employers and employed might act. They say they have been compelled to express doubts as to the efficacy of many of the remedies that have been suggested for irregularity of employment; but at the same time, they admit that the evils of this irregularity are so serious that no real remedy should be neglected merely because its operation would be limited. One great difficulty in regard to the regulation of labour of a fluctuating kind is lack of information which might be utilized for the guidance of those employers, both public and private, who are willing to go out of their way a little in order to confer a benefit upon the working classes. It should be the duty of the Labour Department to attempt this task. The Commissioners think that, with a little forethought, public authorities might, during more prosperous times, prepare plans for works that are needed, but are not urgent, and hold them in readiness for periods of depression.

The Commissioners have not seen their way to recommend Government interference in regard to such industrial matters as rates of wages and hours of labour. They remark that many of the most serious conflicts which have taken place, especially of recent years, in the less skilled and organized trades, have turned upon the employment of non-unionist workmen; and they observe that the causes of such difficulties appear to be beyond the reach of legislation. The connection between the worst phases of these conflicts and the law and practice of picketing is acknowledged; but the Commissioners are of opinion that the existing law is sufficient to meet the case, if impartially and firmly administered. There is reason to doubt, however, whether it is generally understood; and accordingly the Commissioners offer help towards this end by stating that, where the practice of picketing exceeds the bounds of information and peaceable conversation, and takes the shape of besetting the entrance or approaches of a factory or works in a threatening manner, apart from any real threats addressed to individuals, the offence of "unlawful assembly" is committed.

In concluding their recommendations, the majority of the Commissioners desire to record their opinion that, while many of the evils to which their attention was called are such as cannot be remedied by any legislation, they confidently look to their gradual amendment by natural forces now in operation, which tend to substitute a state of industrial peace for one of industrial division and conflict. They admit that the growth and development of large industrial establishments during the present century has necessarily resulted in the creation of considerable bodies of workmen more or less separated in their lives and pursuits from those under whom they work. The mutual ignorance that arises from this separation is regarded as a main reason why so many conflicts take place, turning upon the division of the receipts of the common undertaking between the owners of the machinery and material and the workmen who supply the labour. It is, however, precisely where this very separation of the classes in the industrial world has become most marked, that one of the most hopeful of the influences that make for peace is most conspicuous. Powerful trades unions on the one side, and powerful associations of employers on the other, say the Commissioners, have been the means of bringing together in conference the representatives of both classes, enabling each to appreciate the position of the other, and to understand the conditions subject to which their joint undertaking must be conducted. The Commissioners see reason to believe that, in this way, the course of events is tending towards a more settled and peaceful period, in which, in such industries, there will be, if not a greater identification of interest, at least a clearer perception of the principles which must regulate the division of the proceeds of each industry, consistently with its permanence and prosperity between those who supply the labour and those who supply the managing ability and the capital.

This, it may be observed, is the optimistic view of the position, from which Mr. George Livesey pithily dissents, in the observation that he does not consider that the course pursued by the great majority of trade associations is calculated to produce industrial peace. It will be remarked that Mr. Livesey does not speak here of trade unions merely, but uses, probably designedly, a term which covers organizations of employers as well as those of employed.

The report goes on to assert hopefully that, as the terms of what is virtually a partnership come to be better understood, and the arrangements for adjusting them to the variations of trade are made more perfect in one branch of industry after another, a natural end will be found to the conflicts which have been the result, for the most part, of uncertain rights, and mutual misunderstandings and pursuance of separate interests, without sufficient regard to their common interest, by employers and workmen. This end, the majority of the Commissioners declare pointedly, would not be attained by the way of socialism or collectivism. They do think, however, that industrial peace is promoted by the knowledge acquired by workmen and capitalists of each other's motives; and they look for steady influences tending towards harmony, from the investment by workmen of their savings in different enterprises, and the experience which they thus gain as capitalists on a small scale. Similar effects are caused by the extension of the principle of profit-sharing, of which there is very gratifying and encouraging testimony. A more cordial understanding, a better mutual knowledge, is in the opinion of the Commissioners the one thing needful for the happy future development of the industrial world.

The separate observations appended to the report by the Chairman, Mr. David Dale, Sir Michael Hicks Beach, Mr. Leonard Courtney, Sir Frederick Pollock, Mr. Thos. H. Ismay, Mr. George Livesey, and Mr. W. Tunstill have been much canvassed. They aim at the optional incorporation of associations of employers and employed, for which, however, they admit the evidence does not show public opinion to be ripe. They nevertheless thought it desirable to indicate what may, in their opinion, ultimately prove to be the most natural and reasonable solution of some at least of the difficulties which have been brought to their notice.

Sir Frederick Pollock appends some observations of his own upon the subject of employers' liability. He expresses regret (in which Mr. Mundella and Mr. Thomas Burt share) that circumstances prevented the Commission from considering the question in a more full and definite manner. The minority report, signed by Mr. William Abraham, Mr. Michael Austin, Mr. James Mawdsley, and Mr. Tom Mann, need not engage us long. This composition is worth reading; and so far as can be judged, it does not unfairly represent the protest that might be uttered by sanguine social reformers against the optimism of the majority. Its queer mixture of politics, humanitarianism, and militant trade unionism, however, constitute it an almost hopelessly indigestible dish, even, one would think, for the most robust socialistic appetite. Sir John Gorst follows with a report all to himself; and there are appendices by Mr. George Livesey, Sir F. Pollock, and the Secretary, which are all in their degree worthy of attention.

In closing our notice of the report of the Commission, we desire once more to record our appreciation of the character of Mr. Geoffrey Drage's work in this connection, and to commend the report in its entirety to the careful study of all employers of labour.

The Management of the San Paulo Gas-Works.—We learn that Mr. J. H. Wood, of the South Shields Gas Company, has been appointed Manager of the San Paulo Gas-Works.

Proposed Returns as to Water, Tramway, and Electric Lighting Companies.—According to the last annual report of the Liberty and Property Defence League, the Parliamentary Committee will ask Parliament to order returns to be submitted each year by municipalities and private companies, as is already done in the case of gas, in reference to all water, tramway, and electric lighting undertakings under their respective control, so that the ratepayers may be able to compare the relative efficiency, in respect of the capital employed, of municipal monopoly and private enterprise.

NOTES.

The Character of the Bessemer Flame.

In a paper on "Flame Spectra at High Temperatures," read by Mr. W. N. Hartley before the Royal Society, the author described his spectroscopic and other experiments upon the flame which issues from the mouth of a Bessemer converter. These observations were made at Crewe and Dowlais. Mr. Hartley states that the spectrum of the Bessemer flame is a complex one, which exhibits differences in constitution during different periods of the blow, and even during different intervals in the same period. The most highly luminous flame is produced in the second, or "boil" period, and is due not merely to the combustion of highly-heated carbon monoxide, but also to the presence of the vapours of iron and manganese in the gas. The probable temperature of the Bessemer flame at the finish is that produced by the combustion in cold air of carbon monoxide heated to about 1580° C.; this being the temperature, according to Le Chatelier, of the bulk of molten metal out of which the gas has proceeded. The resulting temperature of combustion must nearly approach that of the oxy-hydrogen flame, and may easily attain the melting-point of platinum, which is 1775° C. Hence at such a temperature iron and manganese are freely volatilized.

The Absorption Spectra of High Temperature Gases.

M. Janssen sends to the *Comptes Rendus* a description of the measures that have been taken and of the results achieved in studying the spectra of gases, and in particular of oxygen, when heated under pressure. He began by heating the gas up to temperatures not exceeding 300° C. by means of a coal-gas furnace, while it was enclosed in a steel tube 10 metres long with glazed ends. The object of this was to ascertain what difference, if any, is made in the spectrum of a ray of light sent through the tube while the temperature and pressure are caused to rise. The experiments were made with various pressures of oxygen; and they showed that for ordinary temperatures up to about 300° C. the bands and rays of the absorption spectrum of oxygen gas do not undergo any appreciable modification. A quite novel fact was, however, discovered, which was that the transparency of the gaseous medium increased very remarkably with its rise in temperature. This was shown by a considerable augmentation of the brightness and the extent of the spectrum, especially at the red end. With a view to increase the range of temperature, recourse was next had to a platinum spiral rendered incandescent by the passage of an electrical current. Still, in all the experiments made by M. Janssen with a tube of from 2 to 10 metres long, and with pressures of gas extending up to 100 atmospheres, no appreciable modification of the spectrum could be observed. The temperatures reached were estimated as lying between 800° and 900° C. The experiments are to be carried farther by the aid of more powerful apparatus.

The Perishability of Glass.

Herr F. Foerster has been experimenting in order to ascertain the extent of the power of acids and of water to act upon glass; and he finds that, with different kinds of lime-alkali glass, the loss of weight resulting after heating with dilute acids to 100° C. for six hours was always the same with the same kind of glass, and was entirely independent of the strength of the acid and of its chemical composition. Very strong acids have less effect upon glass than dilute acids, which again have less action than pure water. This observation bears directly upon the subject of lamp-chimneys. Lead glass exhibits the same peculiarities as lime-alkali glass, according to the proportion of lead contained in it. The action of pure sulphuric acid is less than that of boiling water; but at very high temperatures its vapours produce a more marked effect. Dry carbonic acid does not affect glass; hence the action of the atmosphere upon it depends primarily upon the aqueous vapour contained in it. The liability of a sample of glass to suffer changes from atmospheric influences can therefore be ascertained by estimating colorimetrically the amount of alkali separated by treatment with water. Glass, especially if rich in alkali, is capable of absorbing water which can only be completely expelled by heating to about 500° C. The water enters into chemical combination—forming hydrates, which represent the intermediate stage in the process of the decomposition of the glass by the action of water. An important part played by the alkali split off by water seems to consist in its facilitating the formation of such hydrates. Herr Foerster gives analyses showing that certain inferior soft varieties of glass commonly met with in trade lost in one case 0·217, and in another 0·654 milligramme of alkali over a surface of 100 square centimetres, after eleven days' soaking in water at 20° C., followed by three hours' treatment in water at 80° C. The Stas glass is still regarded as best for resisting the action of chemicals.

The Combination of Petroleum Spirit with Electricity.

A curious phenomenon is afforded by the combination of petroleum spirit and electricity to cause some of the mysterious fires which occasionally break out in factories where the former is much used for its solvent properties. The mineral spirit is extremely volatile; and whenever a fire has occurred through its use, it has been generally assumed that the inflammable vapour must have gained access to a light. It has been discovered, however, that the ignition of petroleum spirit may be caused, in a *pseudo*-spontaneous manner, by its becoming subject to electrical excitation. This happens especially in cold, dry winter weather, when the spirit may become strongly electrified, showing sparks and flashes of light, accompanied by crackling sounds. If these manifestations are allowed to proceed unchecked, the spirit may soon be ignited. In Germany, where the dryness of the winters lends itself to this mischievous electrical effect, Kissling has recently recommended that a small quantity of some kind of soap that is soluble in petroleum spirit should be dissolved in it. Even as little as 0·2 or 0·3 per cent. of such addition will stop the liability of the spirit to electrification. The application of soap to spirit that is actually in a state of electrical excitation never fails to allay it and prevent risk of ignition. This excitation of petroleum spirit is never observed in a moist or warm atmosphere; these conditions being favourable either for carrying off or preventing the electrical manifestations. The efficacy of the soluble soap is possibly due to its providing the necessary moisture; water being otherwise non-miscible with petroleum spirit.

The Management of the Selby Gas-Works.—Mr. M. Dunn, of Stockton-on-Tees, has been appointed Manager and Secretary of the Selby Local Board Gas-Works, in place of Mr. J. S. Naylor, who, as already announced in the JOURNAL, has taken the management of the Droylesden station of the Manchester Corporation.

Mr. Geoffrey Drage on the Unemployed.—We have received from Mr. Geoffrey Drage a copy of his work on "The Unemployed," which has just been published by Messrs. Macmillan and Co. Mr. Drage's name is now so familiar to our readers in connection with the valuable series of reports issued by him as Secretary of the Labour Commission, that no commendation is needed by us for anything he sends from the press. The present volume, of which we can now only briefly indicate the scope, is the result of a conviction which has forced itself upon Mr. Drage, after a careful study of official publications, that the question of the unemployed—which, as he says, in his preface, is perhaps the most urgent, as it is certainly the most difficult, of our social problems—has not hitherto been comprehensively dealt with. Mr. Drage tells us first of all what has already been done to solve this problem, and then, after discussing the nature and causes of the present distress, what can be done to solve it. How he has accomplished his task we shall take an opportunity of showing in an early number.

Death of Mr. J. Burgess, of Huddersfield.—We regret to record the death, on the 6th inst., of Mr. John Burgess, who was for many years Engineer and Manager of the Huddersfield Gas-Works. It was in 1856, while engaged at the Manchester Gas-Works, that he obtained the appointment in the Yorkshire borough, under the Company by whom the gas undertaking was then carried on. When the Corporation purchased the works in 1872, they retained Mr. Burgess's services. He held his position till March, 1892, when, owing to failing health, he relinquished it, and was made Consulting Engineer—Mr. W. R. Herring, who had been acting as Assistant-Manager, undertaking the duties formerly discharged by his chief. Mr. Burgess continued his connection with the undertaking till his death; and both Company and Corporation found him a most able and conscientious servant, who strove zealously and constantly to do his duty faithfully and well. Wherever he was known, he was much respected for his integrity of character, his courtesy, and his kindness of heart. He was an associate member of the Institution of Civil Engineers, a member of The Gas Institute, and a Freemason. Deceased, who was in his 69th year, succumbed to a third attack of paralysis.

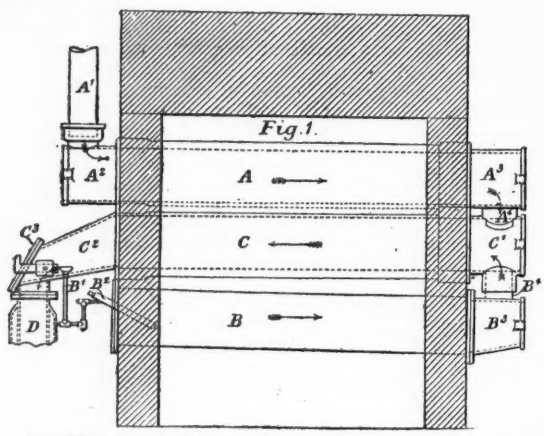
Effect of the Earthquake Shock in Constantinople.—Mr. W. S. M'Gregor, the Engineer of the Imperial Ottoman Gas-Works at Dolma-Baghtche, sends us the following: "A very severe shock of earthquake was experienced in Constantinople on Tuesday, the 10th inst., at 20 minutes past 12 p.m., European time. The first shock lasted about 40 seconds; and a second shock, less severe, was felt about five minutes afterwards. Considerable damage was done to property, and a number of houses were thrown down; while fires of a serious character broke out in different parts of the city. But comparatively little loss of life took place. At the Imperial Gas-Works, at Dolma-Baghtche, the water in the gasholder tanks suddenly overflowed; while in No. 1 holder (a two-lift telescopic holder of 320,000 cubic feet capacity) the water rose suddenly and overflowed the tank, and as suddenly subsided. As the holder was cupped scarcely a sheet in the second lift, it uncupped and cupped again with startling rapidity; the girders and tie-rods meanwhile shaking violently, and appearing as if they would be wrenched away from the columns. The chimney-stalk of the old works was badly cracked, and a portion of the top thrown down; but beyond this, and the flooding of the inlet and outlet pipes of the different gasholders, no serious damage was done. Various ugly cracks about the buildings testify to the serious nature of the shock; and, altogether, if possible, it is not an experience that one would care to undergo a second time."

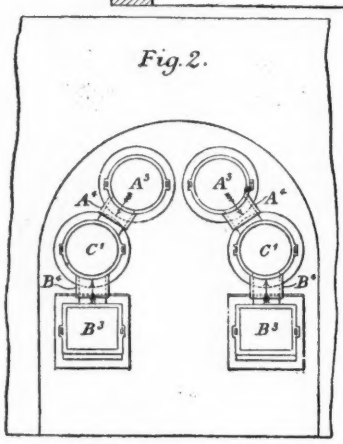
REGISTER OF PATENTS.

Manufacture of Gas.—Dinsmore, J. H. R., of Liverpool. No. 5647; March 16, 1893.

The claim for this invention is: "The employment, in combination, of three separate retorts—one being adapted to receive and heat coal gas, another to distil tar, and the third to receive, heat, and have mixed therein, and rendered permanent and homogeneous, the coal gas and product of distillation of the tar; the retorts being set in a bench or oven heated externally to about the temperature specified."

Alluding to his present proposal, the patentee says: "Under this invention, crude or purified illuminating gas, or other gas of a relatively low illuminating power, is passed through a retort or chamber artificially heated; and tar, or tar and hydrocarbon oil, or oil only, is introduced into another retort or chamber, also artificially and externally heated, and gasified therein. The gas or vapour produced in this retort or chamber, and the aforesaid crude or other gas, are introduced into a separate chamber or retort, artificially and externally heated, wherein both gases (and vapours carried thereby) are heated, and the non-permanent gases or vapours become more or less fixed or permanent. From this chamber or retort, the gases are carried downwards into a suitable hydraulic or other main, and in their descent are cooled artificially; this being done in a simple manner, by surrounding the downtake pipe with a jacket, and providing cooling water in the space or circulating it round the pipe. Thus the action, according to this invention, is: Gas having certain illuminating power, which it is required to raise, is first heated; and tar, or tar and oil, or oil only, is vaporized or distilled, and the resulting vapours and gases and the former gas are mixed and heated, and more or less of the non-permanent gases or vapours fixed or rendered permanent. After this, the gases are passed to the hydraulic or other main in a downward direction, and are cooled in their descent, by which the deposition of solid pitch or carbon is obviated, and the blocking of outlet-pipes prevented."





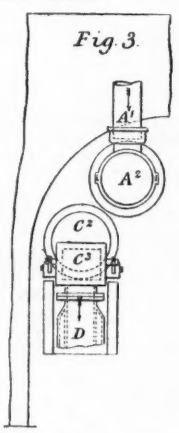


Fig. 1 is a sectional elevation of the apparatus, showing two sets arranged in one bench or oven. Fig. 2 is a front end view of same; and fig. 3 is a view of the opposite end.

Each set of apparatus consists of an upper retort A, into which crude or purified gas, or gas coming from the apparatus of an ordinary gas-works, is introduced; it being led thereto by the pipe A^1. B is the lowest retort of each of the sets, into which tar (or analogous hydrocarbon) is introduced and distilled; the tar or liquid being introduced by the U-trap supply device B^1, the pipe B^2 of which is fixed in the door of the retort, and carried in an inclined direction a certain distance into the retort. C is the intermediate retort, into which the gas from A, and the tar gases or vapours from B are introduced. The former enter by way of the mouthpiece A3, pipe A4, and mouthpiece C^1; and the latter, through the mouthpiece B3, pipe B4, and mouthpiece C^1. C^2 is the outlet mouthpiece of the retort C, having a door C^3 thereon; and D is an externally artificially cooled (say, by circulation of water therethrough) outlet-pipe, by which the gases are conveyed away to a hydraulic main or other outlet or conduit.

The retort B is preferably of iron or steel, and is inclined and preferably flat, as shown, so as to cause the tar to distribute itself over the bottom; and thus obtain a distributed and equalized distillation. The upper retort A and central retort C may be (as shown) ordinary clay retorts.

The door C^3 of the mouthpiece C^2 is inclined; and, when it is removed, access can be had to both the interior of the retort C, and also the interior of the artificially cooled outlet-pipe D.

In operation, the crude gas (as stated) is introduced by the pipe A^1 into the retort A, and passed through; and it there becomes heated. The tar is introduced into, and distilled in the lower retort B; and both the hot tar vapours or gases and the hot crude gases pass into the central retort C, and become therein further heated and mixed under its comparatively high temperature—namely, about a bright red, or 1700° Fahr. In this condition, and by this treatment, "the gases resulting from the distillation of the tar are intermixed with the coal gas, and the whole rendered permanent or fixed and homogeneous." The combined gases are then conveyed to the hydraulic or other main through the artificially cooled outlet down-pipe D, wherein they are cooled before entering the main.

Obtaining Combustible Gases, Ammonia, and Tar from Fuel.—Mond, L., of Regent's Park, N.W. No. 12,440; June 24, 1893.

In a previous patent (No. 3923 of 1883), the inventor described a process for obtaining combustible gases, ammonia, and tar from coal, &c., by burning the coal in a gas-producer, by means of a mixture of air and steam, and condensing the ammonia and tar from the resulting gases; and in a subsequent patent (No. 8973 of 1885), he set forth how a suitable mixture of air and steam for this purpose can be obtained economically by the utilization of the heat stored up in the gases issuing from the producer. He claims to have now found that the yield of ammonia can be considerably increased, by raising this mixture of air and steam to a temperature of not less than 150° C. before it enters the producer.

In order to effect this rise of temperature without the expense of extra fuel, it is proposed to surround the producer in which the fuel is burnt with a box or mantle, forming a hollow space around it. The hot gases made in the producer are also taken through long pipes, preferably arranged zig-zag, and surrounded by wider pipes, forming an annular space. The mixture of air and steam is passed, on its way to the producer, through this annular space, in a direction contrary to the current of the gas, and subsequently through the hollow space formed round the gas-producer; and it is taken from thence into the bottom of the producer. The gases leaving the producer are cooled in their passage through the long pipes; but they still retain heat enough to serve for the purpose of the production of a mixture of air and steam, as set forth in the 1885 patent.

Before stating, in definite terms, the claims for the invention, the patentee remarks that he is aware that circular gas-producers, with an annular space round them for the purpose of heating the air entering the producer, have been described long ago, and also that several devices have been described for heating this air by means of the waste heat of the gas-producers; but none of these are said to be sufficient to attain the rise of temperature required for his purpose. He is also aware that it has been proposed to use a mixture of superheated steam with cold air for obtaining ammonia from fuel burnt in gas-producers; but this, he says, becomes impracticable if the mixture of air and steam is obtained economically—as, for instance, by the method described in patent No. 8973 of 1885. On the other hand, if the steam required has all to be raised in steam-boilers, and to be superheated sufficiently to attain the object of the present invention, a greater expenditure would have to be incurred for extra fuel than would be compensated for by the increase in the ammonia obtained. He believes that he has been the first to discover that, by burning fuel with a mixture of air and steam in proper proportions, raised to a temperature of not less than 150° C., the quantity of ammonia obtained from the fuel is largely increased; also that he has been the first to design apparatus by which such a mixture of air and steam can be economically raised to this temperature by the waste heat of the gas-producer, without any expenditure of extra fuel.

Regulating the Flow of Gas and Fluids.—Booth, J., and Kirk, T., of Birmingham. No. 14,687; July 31, 1893.

This invention relates to the valves of gas-cocks employed for regulating or controlling the flow of gas therefrom (but is also applicable to regulating or controlling the flow of other fluids); the object being that the flame may be turned down low without being turned out.

The cock is provided with a cylindrical plug, having a screwed thread of a fine pitch, which engages a cylindrical hole with a corresponding screw in the cock, and is gas-tight. The body of the cock has the usual gas-ways; and the plug has a hole through it. It is provided with a handle for imparting motion of partial rotation controlled by a "nighting" pin, and regulating the flow of gas. There is a groove round one-half of the circumference of the plug, which is less in cross section than the hole in the plug. When the handle is moved in one direction as far as the nighting pin will allow, the hole in the plug corresponds with the gas-ways in the body of the cock, and the flame is full from the burner. But when the plug is again moved in the opposite direction, through an angle of about 90° (just as far as the nighting pin will allow) the gas passes through the groove of the plug, and, being smaller, the flame is reduced in size. To regulate the flow of gas, and thus the size of flame, a set screw is employed, the point of which passes into the gas-way.

Gas-Producers.—Abel, C. D.; communicated by the Gas Motoren Fabrik Deutz, of Köln-Deutz, Germany. No. 21,089; Nov. 6, 1893.

This invention relates to the construction of gas-producers in such a manner that strong slagging or caking fuel (as coke) can be used for the manufacture of combustible gas with the same facility as anthracite, inasmuch as it permits of a rapid and effectual clearing of the producer chamber from the accumulated slag or caked material. In addition, the producer enables a variation between wide limits of the quantity of gas produced to be effected, without in any way altering its quality. This object is attained by making the gas-producer

with a chamber enlarged to a rectangular shape at the lower parts, and there provided with two opposite doors of the full width of the chamber, for the purpose of enabling the slag or caked material adhering to the sides of the chamber to be readily removed. Loose protecting shields are placed in front of the doors, so as to leave a protective body of air between the two. Two or more steam-jet injectors are employed, any one or more of which may be put in or out of action, for the purpose of increasing or decreasing the quantity of gas to be produced.

Cut-Off and Purifier Valves for Gas-Works.—Gareis, J., of Cologne. No. 24,788; Dec. 23, 1893.

The patentee claims for his valve the following advantages: (1) The tight-surfaces of the valves, which are ground on each other, do not lift off, but slide while firmly pressing against each other; and they do not permit of any deposits taking place, as the surfaces are always automatically cleaned by the action of sliding. (2) The tight-surfaces lying on each other are exactly equal; thus covering each other completely and quite accurately in the position in which the valves are closed. They therefore do not come at all into contact with the gas in this position, but only for a moment when they are in motion. (3) Between the tight-surfaces lying on each other, "consistent machine-grease is continually being pressed," so that an absolutely reliable and hermetically tight shutting-off is obtained.

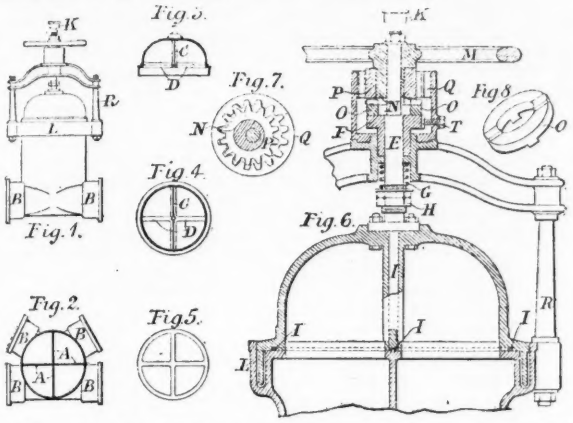


Fig. 1 shows the front-view of the valve; fig. 2 a section through the body of the valve; fig. 3, a vertical section through the valve-cap; fig. 4, a section through the valve-cap; fig. 5, a front view of the tight-surfaces. In figs. 6, 7, and 8 details are shown on a larger scale.

The valve consists chiefly of the lower part or valve-body (bearing the various pipe-joints), and a cap which turns on it about a vertical centre axis. The lower part is divided by four vertical partition-walls (forming a cross in the section) into four separate chambers, each of which communicates with a pipe-joint B. The cap, on the other hand, is divided by a vertical middle wall C into two chambers, only in such a manner that, according as the wall C is brought on to the one or the other axis of the cross of the partition walls in the lower part by the rotation of the cap, two pairs of chambers, lying near each other in the one or the other direction in the valve, are connected with each other by one chamber of the cap. Quite at the bottom of the cap (as in figs. 3 and 4), starting from the middle of C to the outer wall, are two vertical ribs D, standing at right angles to C, are cast on. These ribs form the same tight-surfaces on their bottom as are offered by the wall C and the transverse walls A; so that the tight-surfaces, when looking from above towards the lower part of the valve, as well as from below towards the valve-cap, show the same figure of a circle with a cross in the interior, as represented in fig. 5. These surfaces are therefore, as has already been mentioned, perfectly equal; and when the wall C stands on the transverse wall of the valve in the one direction, the tight-surfaces of D lie on the otherwise free surfaces of the partition-wall, which has a direction at right angles to C, in order thus to prevent the action of the gases and the deposit of impurities on the latter tight-surfaces.

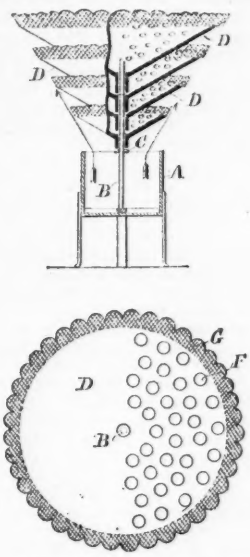
The rotatory motion of the cap or bell is accordingly 90°; and it is accurately limited by the screw T, visible above in the turning mechanism in fig. 6. The vertical axis E, which serves to turn the cap, lies, as usual, so as to be able to rotate in a traverse S, attached, by means of posts R, to the upper margin of the valve body. A strong and only slightly elastic spiral spring G, pressing from below against S, drives the cap continually downwards, and thus forces the tight-surfaces, which are rubbing against each other, firmly together. This spring may be bent, according to need, by the nut H.

Consistent grease, contained in a vessel K attached to the upper part of the axis E, passes through suitably arranged channels I between the tight-surfaces, which are rubbing against each other—lubricating them, and at the same time helping to produce an absolute tightness. The lower part of the valve is provided on its upper margin with a cup L running all round, the depression of which is filled with machine-grease, and into which dips the overhanging lower edge of the cap (fig. 6). The depth of the cup is so adjusted, that the greatest inside gas-pressure is not able to overcome the adhesion between the grease and the surface of the cap—*i.e.*, those parts of the cap that dip in—so that the valve is perfectly tight towards the outside, even if, in consequence of injury, it should happen that the inner surfaces between the lower part and the cap allow gas to leak through.

As the surfaces of the valves slide on each other under pressure, and the adhesion of the grease has to be overcome, the rotary motion of the cap would (especially in large valves) require much force and be very troublesome. The mechanism as shown in figs. 6, 7, and 8 is intended to make this easier. In the casing attached to the traverse S there is gearing arranged, which requires from two to three entire revolutions of the hand-wheel to make the cap turn through 90°. The nave of the hand-wheel M is provided in a downward direction with an eccentric continuation N, on which a small toothed-wheel P is made to rotate, by catching into the upper edge of the case, which is formed with a cogged rim Q. During this motion of the toothed-wheel P, its centre describes a circle about the vertical axis of the valve. The rolling motion of the toothed-wheel is converted into a slow rotary motion of the cap, by the insertion of the carrier O (in perspective in fig. 8), catching into corresponding grooves on the lower side of the toothed-wheel, with two upper slide-pegs and with two lower pegs placed at right angles to them, into grooves on the upper side of the nave F, which is firmly wedged into the axis of the cap.

Incandescent Gas Lighting.—Bernstein, M., and Silbermann, A., of Berlin. No. 7372; April 13, 1894.

This invention relates to the construction of an illuminating incandescent body, formed of a series of conical plates of various diameters built up one on the other (the undermost being of the smallest diameter), perforated round and near the apex, and having a porous outer edge, so as to afford great illuminating surface, and of radiating power.



Within the Bunsen burner A is arranged a cross piece on which a rod B is supported. At about the upper end of the burner is a flange C on the rod B, which supports conically-shaped plates D, by means of their lower perforated bosses. The outer edges of the plates are bevelled off to the same angle in all the plates; and the latter are of such diameter that, when arranged one over the other, the bevelled edges shall all lie in the same straight line, so that lines drawn from the edge of the upper plate, and passing along the bevelled edges of the plates below, would all meet (if prolonged) at a point within the burner. The body of the plates may be perforated, as at F, or plain; but the edges are made porous all round, as shown at G. The plates are superposed in the manner indicated—the lowest having the smallest diameter, and the uppermost the largest; the intermediate plates gradually increasing in diameter. The body of the plate may be conical or curved, and the upper edges plain or notched.

The plates are made "of pure chamotte (a mixture of refractory clay with broken saggers) or kaolin, or of a mixture of the same, with an addition of graphite, water-glass, or the like, and can be produced either by a cold or hot process. The porous rim round the edge of the plates is produced by the addition of sawdust, or cork meal, during the manufacture of the plates in the well-known manner."

The finished plates are dipped in an illuminating liquid, such as magnesium oxide (MgO), and then arranged on the rod B, so that they can be easily removed, in case they need to be replenished with the illuminating liquid, or replaced by new plates.

By means of this device, say the patentees, "the combustion gases coming from the burner are forced to take their way along the edges of the plates, in the form of a cone having an intensely luminous centre or core."

APPLICATIONS FOR LETTERS PATENT.

12,271.—Whiteley, W. J., "Gas-engines having slide-valves. June 25.

12,353.—Littlewood, F., "Gas-stove." June 26.

12,469.—Hatry, C., "Incandescent burners." June 27.

12,663.—Hermite, E., Cooper, C. F., and Paterson, E. J., "Purification of gas." June 29.

12,684.—Rock, A. L., "Regenerative or other gas-furnaces." June 30.

12,776.—Nicholson, T., "Use of gas for heating purposes, and rendering the cheaper kinds available for gas-engines, storeage, and carbonization." July 2.

12,820.—Tyler, A. H., and Vesian, J. S. E. de, "Mixing and burning inflammable and explosive gases and vapours." July 3.

12,840.—Terry, S. H., "Cooling the circulating water in gas, oil, and other engines working by explosion of vapour or gas in cylinders, and heating the air to be mixed with the oil or gas previous to explosion." July 3.

12,881.—Lake, H. H., "Obtaining ammonia and ammonia salts from nitrogenous organic matters." A communication from L. Sternberg. July 3.

CORRESPONDENCE.

[We are not responsible for the opinions expressed by correspondents.]

Mr. Stelfox on Carburetted Water Gas.

SIR,—I have to thank you for the courtesy of your references to my recent paper; and as my desire in preparing it was simply to let my brother engineers have the benefit of my very satisfactory experience, I do not propose to enter upon any controversy upon the subject. There are, however, one or two small matters in connection with your observations which I think you would wish me to notice, because I feel sure you only desire to examine fairly the credentials of the "little stranger;" and, if these are found satisfactory, to accord him a hearty welcome into the family circle.

(1) All the results submitted in my paper, except the last, were obtained with oil at 2¾d. per gallon.

(2) The average cost of gas into the gasholders in the 35 gas-works whose accounts are tabulated in Mr. Field's "Analysis" is 17·41d. per 1000 feet *sold;* and in only eleven cases does the illuminating power supplied exceed 17 candles. My figures were per 1000 feet *made;* so that, for purposes of comparison, I must add (say) 0·7d. per 1000 feet to the figures given for actual cost of gas into my gasholders. The proportion of salaries fairly chargeable in this department I left out designedly, so that each could proportion the amount for himself. Glancing at the cost under this heading in the tabulated returns, it seems that 0·3d. would be a fair rate to assume. With these items added, the cost of gas as given in my experiments, but calculated at per 1000 feet sold instead of made, would be—

Experiment No. 1	15·31d.	for 26·22 candles	
" 2	13·46d.	" 20·445	"
" 3	13·76d.	" 21·5	"
" 4	14·068d.	" 21·65	"
" 5*	13·41d.	" 21·47	"

With these items added, what are the "burdens" which remain on the common coal gas which should be chargeable to water gas? The items in Field's "Analysis" over which the comparison was made are salaries, wages' (carbonizing), purifying, and wear and tear; and these are all covered in my estimate of cost. Rents, rates and taxes, and incidental charges are *not* included in the comparative figures in either case; and these "burdens" must be added alike to both. I venture to submit that, *even without reference to quality*, these are low prices for gas as compared with the average returns already referred to.

(3) As justifying my anticipations in reference to the prospective price of oil, on which point I am pleased to have your concurrence, I may mention that during the past week I have been able to negotiate for about two years' supply of refined oil at 2d. per gallon. This price applied to my figures would mean a reduction of cost of about 2d. per 1000 cubic feet in experiment No. 1, of about 1½d. per 1000 feet in experiments Nos. 2, 3, and 4, and of ¾d. in experiment No. 5. With this allowance, the cost into the gasholder would be as follows per 1000 feet sold:—

Experiment No. 1 . . .	13·31d.	for 26·22 candle gas.	
" 2 . . .	11·96	" 20·445	"
" 3 . . .	12·26	" 21·5	"
" 4 . . .	12·56	" 21·65	"
" 5* . . .	12·66	" 21·47	"

(4) I propose to leave the carbonic oxide question to the chemists and doctors. Eminent members of both professions have stated that the constituents of coal gas are quite as injurious as those of water gas; the larger proportion of marsh gas in the one balancing the extra quantity of carbonic oxide in the other. My contention, however, is that no one in his waking senses should ever inhale as much of either as would be dangerous, and that asphyxiation should only be possible in case of serious accidental leakage in a sleeping apartment or under similar circumstances, in which case the result would probably be the same, however much the constituents of the gas inhaled might vary. As regards the proportion of carbonic oxide permissible in Continental gas, I may remark that a mixture of half and half of coal and water gas—and I think this is as far as the mixture is likely to go in this country for a long time to come—would probably not contain more than the percentage allowed.

Belfast, July 13, 1894. JAMES STELFOX.

* Value of tar in this experiment not ascertained.

Mr. Newbigging's Gas Institute Paper.

SIR,—It was not my intention to offer any observations upon Mr. Newbigging's paper; but his letter obliges me to say that, although in sympathy with the movement for a lower standard of illuminating power, I am unable to agree with his reasons in support of it, so far at least as I think I understand them.

Mr. Newbigging has formed the opinion—founded upon ordinary observation—that the lower qualities of gas yield a lighting effect superior to that which is afforded by nominally much higher qualities; and he imagines that this superiority is traceable, in some undefined way, to certain distinctive properties recognized by "the two old-world and suggestive terms, *quantity* and *intensity*." At the same time, he deplores a system of photometry which fails to support his views, or to reconcile experimental results with what he designates illuminating effect.

Although Mr. Newbigging has probably claimed too much for low-quality gas, there can be little doubt that this does possess a value in excess of what is expressed by its nominal illuminating power. The explanation of this—if common-place—affords a solution of much of Mr. Newbigging's perplexity. It is to be found in the existing method of testing. Nearly a quarter of a century ago, I showed, by a series of experiments, the depreciating effect of Argands (and particularly of the standard Argand) upon the lower qualities of gas; and not long since you published letters from me upon the same subject, accompanied by a diagram indicating the loss which occurs through adherence to the 5-feet rate.

Dealing with Mr. Newbigging's own illustration, for example, the reason why so-called 18-candle gas does not, in actual use, give 28·5 per cent. (not 30 per cent. as he has it) more light than so-called 14-candle gas, is because the latter is not tested in a manner comparable with that in which the 18-candle gas is tested. Were it so tested, it would be rightly called about 16-candle gas, which is the proper measure of its efficiency when used with a flat-flame burner, Mr. Dibdin notwithstanding. It is probable that more will be heard of the experiments upon this point which that gentleman has lately submitted to the London County Council.

It would be interesting in this connection to know the authority for Mr. Newbigging's statement that, "tested by the standard photometer, even employing a good burner of the very best design and construction, if it be of the flat-flame type, in consuming gas of 14 to 16 candle power, there is a sacrifice of something like 40 to 60 per cent. of the available light, as indicated by the standard Argand." Such was not the experience of the then Gas Referees as far back as 1871, when, with 15-candle gas, they assessed it at less than 14 per cent. Nor does it agree with my own experience. With regard also to Mr. Newbigging's statement, that "it is a fallacy to say that the flat-flame burner gives, under test, a higher value than the Argand with 20-candle gas and upwards," it may be pointed out that this is not in accordance with the experiments of Mr. E. L. Pryce (JOURNAL OF GAS LIGHTING, May 17, 1892, p. 906), which award the superiority to flat-flame burners for gases of very high quality.

On the subject of intensity of lighting, Mr. Newbigging appears to be somewhat at variance with himself. From paragraphs 2 and 12 of his paper, it might be inferred that he is opposed to it; but later on in the paper he refers—and, in my opinion, very rightly—to the development of incandescent lighting (which does give intensity) as an argument in favour of a lower quality of gas. Nor does it appear that he is aware that intensity of gas lighting can be altered by means of burners.

The distinction which Mr. Newbigging seeks to draw between illuminating power and illuminating effect seems to me to be simply a question of burners. That the richer gases—say, from 18 candles upwards—are at a disadvantage in this respect, admits of little doubt; and this is indeed one of the chief arguments in favour of a reduction in the case of such gases. So far, however, as I can see, there is no ground for the belief that consumers would obtain an equal lighting or heating gas from so-called 14-candle gas as from so-called 16-candle gas; although the actual difference (owing to the mode of testing) will not be two candles as indicated by the photometer, but only about three-quarters of a candle.

Mr. Newbigging takes exception to my having spoken of "gas of a low quality." My meaning would have been better expressed by the phrase "gas of a *lower* quality;" but, as will be seen from the above, I could not conscientiously assert, with Mr. Newbigging, that "this is not only cheaper but better than the other."

Birmingham, July 14, 1894. CHARLES HUNT.

Mr. Dibdin and Enrichment.

SIR,—Mr. Dibdin, the Superintending Gas Examiner of the London County Council, with all the force of an Act of Parliament to give momentum to his words—an Act, the provisions of which were based on insufficient knowledge—can urge strong measures without the necessity for backing them with strong arguments, or, indeed, any arguments at all. In effect he says: "The law provides that London gas must be of at least 16-candle illuminating power; and, by hook or crook, of 16-candle illuminating power it shall be!"

For an executive officer, that conclusion is quite right. Nobody objects to the fact under the law. But a dictum of this kind settles nothing, except that the provisions of an Act of Parliament must be enforced. We have travelled beyond that point. What is wanted is an alteration and amendment of the law; and if Mr. Dibdin has any arguments to adduce why there should not be such amendment in the direction of a reduction not of the quality of the gas, but of the standard of illuminating power as indicated by the photometer, let them be forthcoming. They will be received with all the respect due to so eminent an authority.

In the meantime, I still hold that the fortnight's experiment of the South Metropolitan Company, of supplying gas produced from Durham coal, without enrichment—and during which period not a single complaint of want of illuminating value was made, although the photometrical power, using the standard candle, was as low as 13·9—goes a long way to establish the truth of my contention that the illuminating power as shown by the photometer, and the illuminating effect of the gas in actual and practical use, are not synonymous; and that, although 13·9 is 13 per cent. less than 16, it does not follow that the illuminating value is so much, if any, less.

Mr. Dibdin may or may not be in favour of a reduction in the standard. In the meantime, it is clearly his duty, as an official, to see that the Act is enforced.

Manchester, July 11, 1894. THOMAS NEWBIGGING.

The Investment of Working Men's Savings.

SIR,—In my early days, application had to be made to Parliament for an Act of Incorporation in every case, and shares were generally fixed at £50 or £100 each, to be paid up by instalments as and when required. Any person taking a share rendered himself liable to pay those instalments when made; and with that his further liability ceased. Many establishments were carried on as joint-stock undertakings, without the public having any means of knowing whether or not they were conducted by incorporated companies, although any person taking a share in such an undertaking made himself liable not only for the portion of his own share unpaid, but also for all debts of the undertaking, whatever they might be. It may therefore be said that it was all but impossible for a working man to become a shareholder in any undertaking in which he was himself employed.

When railways came into operation, and the demand for further capital became greater every year, the shares were reduced from £50 to £25, then to £20, then to £10, and in some cases to £5; and a Public

Act was passed to authorize the formation of joint-stock undertakings as limited companies (by way of distinction from other companies), without the necessity of applying to Parliament in each case. In this Act, the liability was, the same as in the other Acts, limited to the amount unpaid upon the share; but as the promoters were allowed to fix the amount of their own shares, if they were satisfied with but a small amount per share it gave the working man an opportunity of becoming a small shareholder whenever he was able to do so.

Now, however, all new capital for gas purposes is required to be sold by auction, and to be paid up at the time of purchase; and as there is, in nearly all the Gas Acts recently passed, a clause providing that no lots under sales by auction shall be less than £50 or £100, the working man's chance of becoming a shareholder is less than ever. The working man has thus no means of investing his savings safely except through the Post Office, where the interest allowed is so trifling that he is tempted to seek better terms elsewhere; and this, as recent events have shown, frequently results in the total loss of both principal and interest, which, so far as gas companies are concerned, might, by a little judicious management on their own part, be avoided.

All or nearly all gas companies are allowed to have a certain portion of borrowed capital invested in their undertakings—generally about one-fourth of their paid-up share capital—and to create debenture stock for this amount. If, then, they would set apart a portion of such stock—and only a very small portion would suffice—and permit their own workmen to take it up at par, and allow the usual rate of interest upon every £10 thus taken up, much benefit might be conferred upon the men, without any prejudice to the companies. A resolution passed at any general meeting would suffice for the purpose.

Chiswick, July 13, 1894. W. LIVESEY.

Income-Tax on Dividends.

SIR,—I thank "LL.B. (Lond.)" for his letter; but, unfortunately, he throws no light whatever on my questions. His view is all very well from a shareholder's point. The Inland Revenue Commissioners, no doubt, quite understand their duties, and how to protect the revenue interest; but that point is not involved. These gentlemen are necessarily very unreliable authorities on the proper interpretation of the Gas-Works Clauses Act, under the provisions of which my difficulty arises.

July 12, 1894. PROVINCIAL SECRETARY.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following progress has been made with Bills:—

Bills read the first time, and referred to the Examiners: Huddersfield Water-Works (Tramroad) Bill, Thames Conservancy Bill.
Bill read a second time and committed: Cardiff Corporation Bill.
Bills read the third time and passed: Cardiff Corporation Bill, Hebden Bridge Gas Bill, Wakefield Corporation Bill.

HOUSE OF COMMONS.

Tuesday, July 10.

THAMES CONSERVANCY BILL.

On the order for the consideration of this Bill,

Mr. STUART stated that since the adjourned debate on the 28th of June (see *ante*, p. 43), meetings had been held between the promoters of the Bill and representatives of the London County Council, with a view to coming, if possible, to a settlement which would be satisfactory under the existing circumstances. As the result, he asked leave to withdraw his amendment for the recommittal of the Bill. This being done, he proposed subsequently to move certain amendments which had been agreed upon, the net effect of which would be that the number of representatives of the Corporation of London and of the London County Council upon the Conservancy Board should each be increased by two.

The amendment to recommit the Bill having been withdrawn,

Mr. STUART, on clause 5, moved an amendment, in terms of his previous statement, increasing the number of Conservators from 33 to 37.

Mr. BRYCE, speaking for the Board of Trade, expressed his satisfaction that the promoters had assented, in a fair and reasonable spirit, to the compromise suggested. He gathered that the Bill would now meet with no opposition in the House of Lords.

Mr. JACKSON, as Chairman of the Committee to whom the Bill had been referred, said he thought a great concession had been made to the County Council; and he was quite sure that they in good faith accepted the arrangement. He somewhat reluctantly assented to the course proposed; but nevertheless he hoped the efforts made to arrive at a peaceful settlement would not have been in vain.

Sir G. RUSSELL, like the previous speaker, reluctantly acquiesced in the arrangement. He said he felt he was submitting, not to a judicial tribunal exercising its judicial office, but to a *tour de force*. He could not but express the opinion that this practice was tending to bring Committees, and even the House itself, into discredit.

Mr. H. F. PEASE and Mr. PAULTON, as members of the Committee, said they believed the decision arrived at was fair and just.

The amendment was agreed to, as were several consequential amendments; and the Bill was set down for third reading on the following Thursday.

Thursday, July 12.

On the order for the third reading of the Bill,

Sir T. SUTHERLAND moved—"That the Bill be recommitted to the former Committee, and that it be an instruction to the Committee to insert provisions in the Bill for establishing distinct statutory Committees of the Conservancy Board to manage the upper river and the lower river (including the port and harbour), to define the limits within which the jurisdiction of such Committees should respectively extend, and to provide for allocating to purposes of the lower river, port, and harbour the income arising therefrom."

Sir D. MACFARLANE seconded the motion.

Mr. JACKSON said he believed the honourable baronet (Sir T. Sutherland) would find that the arrangement indicated in the question was carried out by the Bill.

Mr. BRYCE pointed out that, if the Bill were recommitted, it would be impossible to send it up to the House of Lords this session; and all the time and money that had been expended upon it would be lost. It seemed to him unreasonable to say that the interests of the Port of London were not fully represented on the Board, because there were certainly 24 out of the 37 members who were closely connected with London. After careful consideration, the Committee had come to a settlement in regard to many important differences; and he hoped his friend would not press his resolution, which, if it did not wreck the Bill altogether, would have the effect of disturbing the decisions the Committee had come to, and delay for an indefinite period the carrying out of their recommendations.

The motion was then, by leave, withdrawn; and the Bill was read the third time.

The following progress has been made with Bills:—

Bill read a second time and committed: Consett Water Bill.
Bill reported, with amendments: Accrington District Gas and Water Board Bill.
Bills read the third time and passed: Huddersfield Water-Works (Tramroad) Bill, Pontypridd Water (Tramroad) Bill, Thames Conservancy Bill, Water Orders Confirmation Bill.

HOUSE OF LORDS COMMITTEE.

(*Before Lord* NORTHINGTON, *Chairman; the Earl of* MALMESBURY, *the Earl of* ROSSE, *Lord* LAMINGTON, *and Lord* HATHERTON.)

Tuesday, July 10.

EAST LONDON WATER BILL.

This Bill, by which the East London Water Company seek further capital, and power to carry out additional works, and which was fully considered when before the Committee of the House of Commons,* came to-day before the above Committee.

Mr. PEMBER, Q.C., Mr. CRIPPS, Q.C., and the Hon. A. LYTTELTON appeared for the promoters. The Bill was again opposed by the Corporation of London, who were represented by Mr. LITTLER, Q.C., Mr. RIGG, and Mr. HENRIQUES; the London County Council, for whom Mr. FREEMAN attended; and by the Corporation of West Ham, represented by Mr. LITTLER and Mr. BAGGALLAY.

Mr. PEMBER, in opening the case, described the objects of the Bill, and the works which were proposed to be carried out under it. He also referred to the report of the Royal Commission, and contended that it was entirely in harmony with the works proposed. He remarked that for the London County Council to assert, as they now did in their petition for the second time, that the report confirmed the opinions held by the Council, was a complete falsification of the fact. It might be taken for granted that the Council were largely interested in the water supply of London; but as the works now projected were principally for Essex, this fact had hardly anything to do with the matter. Dealing further with the petition of the Council, and with the suggestion of a supply from some other source, he said they imagined that water supplies could be picked up from any Welsh or Scotch hill, or from any Cumberland lake; but experience of the Loch Katrine and other large supplies showed that they only averaged 50 million gallons, or one-fourth of the present supply of London, one-eighth of that to which the Royal Commission looked forward, or one-sixteenth of the ambitious and over-confident ideas of the Council. Therefore, to decline to take the 150 million gallons which were lying at their doors, and which everybody worth quoting said was very good water, would be perfect madness. He maintained that it was not at all relevant to the present inquiry whether or not the Council or any other water authority should purchase the undertakings of the London Water Companies. The constant attacks of that body destroyed the credit of the Companies to the extent of at least ¼ or ⅛ per cent.; and so, by preventing them from borrowing money more cheaply, they themselves, by their conduct, put a burden on the consumers. The case for the Bill was contained, he said, in Mr. Binnie's own report to the Council, wherein he stated that "mere opposition to the applications of the Companies by the Council must be followed by certain and ignominious defeat, for the whole drift of the evidence placed before the Royal Commissioners by the witnesses for the Council went to show that London requires more water and extended works; and if the Companies are to continue to perform the duties imposed upon them, further powers of some kind must be conferred."

Mr. *W. B. Bryan*, M.Inst.C.E., Engineer to the Company, was then examined by Mr. CRIPPS, and repeated the evidence given by him in the other House as to the increase of population in the Essex district of the Company, for which the additional storeage capacity was required to take in waters which Mr. Binnie and the Royal Commission agreed were running to waste. The reservoirs proposed were the first instalment of the scheme which he brought before the Royal Commission absolutely and without any deviation; and they were accepted by the Commission.

Cross-examined by Mr. FREEMAN, witness stated that part of Ilford, Barking, and Romford, which were within the Company's parliamentary district, were supplied by the South Essex Water Company; and that the system of overlapping districts was not peculiar to the East London Company, as most of the Companies had adopted it. The New River Company overlapped the East London Company. The

* See JOURNAL, Vol. LXIII., pp. 805, 1177.

increased money powers asked for were one-fifth of the present capital, which was a very small addition as Water Bills went. At the present time, the Company were not using all their available sources of supply, because they had not the duplicate machinery and engine power for raising water from the wells. They could not get from these wells 6 million gallons more water, because most of them were in course of construction; and in order to pump that quantity, they would have to withdraw all their workmen, and close the wells for the season. They had at present 7000 feet of tunnel at Lea Bridge, and 900 feet at Walthamstow; and until the work was finished, the tunnels could not be utilized, otherwise the men would be drowned out. Within two years they could have the Racecourse reservoir ready for use to a large extent, and the other two new reservoirs at the end of seven years. The East London Company had 20½ days' storeage, as compared with 7½ days in the case of the New River Company, who also drew water from the Lea. Questioned with regard to the purity of the river, and the pollution from the Hertford sewage and the Manifold Ditch, and as to whether, since the report of the Royal Commission, any effort had been made to prevent the things then complained of, witness said the East London Company were not entitled to take any action against parties polluting the river, as this could only be done by the Lea Conservancy Board. The Company had, however, served notices on the Board, with a view to getting the pollution minimized as much as possible; and he was informed that there was a scheme now before the Conservancy Board and the Hertford Corporation for dealing with the sewage. Any sources of pollution which came to his knowledge or to that of the Conservancy were examined and reported upon by Major Flower, and put a stop to with all practical speed; while the offensive material which was brought down in flood time was excluded from the reservoirs by shutting the intakes during the flood, and for a short time afterwards. The large water scheme for the Thames Valley would not affect the East London Company, because their main could not take more than the 10 million gallons a day they were allowed to draw from the Thames. It would cost £200,000 for a new main to take any additional quantity of water from Sunbury; while if they had to go five or six miles further to Staines, this would entail an extra cost of £7000. There had been no joint scheme between the East London and New River Companies, such as suggested by the Royal Commission.

Mr. FREEMAN, referring to the proposal of the County Council to introduce a Purchase Bill next year, asked if it was not unreasonable to put those works upon the purchaser without his having any voice in the matter.

Witness said he did not think so. The works could not turn out to be absolutely useless, for they were needed whoever was the water authority. They could not hinder the development of the district, and more water must be obtained; and this could not be done without the proposed works.

But they will not yield more water till seven years hence?—Yes, they will. It would take two years to complete the Racecourse reservoir; and the additional pumping machinery which would be at once put down would enable them to obtain more water from their wells with safety.

Assuming that your Company are *bonâ fide* going to be purchased within a short period, what is the danger of allowing these works to stand over a short time longer?—It would be a monstrous thing to prevent Essex having a good supply of water while the County Council are making up their minds. The Council have not at present power to purchase, or to do more than send letters to and fro. It would be some time before they were in a position to purchase; while if they went to Wales for a supply, this would not be available for about fifteen years. Is Essex to go without water during this period?

Cross-examination continued: He did not say the works would improve the selling value of the undertaking. If the County Council came ten years hence, and sought to buy up the Company on the basis of the position and revenue of the concern in 1893-4, no doubt it would suit their purposes, but not the Company's. He therefore thought the works ought to be brought into account in determining the selling value.

Mr. CRIPPS suggested that Mr. Freeman was travelling outside his province in cross-examining the Company's Engineer on matters of policy.

The CHAIRMAN said he had thought so for some time. The questions relating to purchase had better be dealt with by the managers of the Company, or by an actuary, who would be acquainted with the figures, rather than by the Engineer.

Mr. FREEMAN said the reason he put the questions to Mr. Bryan was that he had no guarantee that the promoters would call a Director, or any such witness.

Mr. BAGGALLAY, representing the Corporation of West Ham, said their opposition was on clauses relating to assessment and garden charges.

The CHAIRMAN said they must keep the preamble of the Bill separate from the clauses; but they might depend upon the Committee applying themselves to the difficult questions which he was aware must come up upon clauses.

Mr. BAGGALLAY said that, so far from wishing to mix up the two things, he would say that West Ham wanted the Bill to pass, because the borough was one portion of the district which was absolutely dependent upon the Company getting the reservoirs and other powers to increase their water supply.

The CHAIRMAN inquired if, in the event of a vast water scheme being undertaken by the Council, such as the Birmingham scheme of last year for bringing water from Wales, the works now proposed would be of any use.

Witness said he thought they would; and up to that time they would be absolutely necessary.

Sir *F. Bramwell*, F.R.S., was examined by Mr. LYTTELTON in support of the Bill. He stated that the works were necessary to enable the Company to afford a constant supply of water without intermission, and that it would be a disastrous thing if they were suspended in view of the County Council's future proceedings.

Mr. *E. R. Cook*, speaking on behalf of the Woodford Local Board, West Ham, and other Essex districts, said that the sooner the proposed works were carried out the better, as the large increasing population rendered them absolutely necessary.

Mr. *A. Saville*, for the Chigwell, Buckhurst Hill, and Chingford districts, and Mr. *C. G. Musgrave*, for Leyton, both members of the Essex County Council, gave similar evidence.

The case for the promoters then closed.

Mr. *C. Harrison*, Vice-Chairman of the London County Council, was then called in opposition to the Bill, and entered at length into past contests between the Council and the Water Companies, the proceedings before the Royal Commission, and the communications with the Companies on the question of the proposed purchase by agreement. Since the Bill was before the Committee of the House of Commons, the Council had passed resolutions for the promotion of eight separate Bills for the acquisition of the Metropolitan water undertakings; and in November next, the notices would be issued in due course. Ever since the creation of the Council, a policy had been steadily pursued by them to become the Water Authority for London, to acquire the water-works, and, if advisable, to supplement the supply from other sources. Having regard to these proceedings, the Council entertained a very strong opinion that it was undesirable that the large sums of money proposed to be laid out under the present Bill should be expended without their having any voice in the matter.

Some discussion took place as to whether the decision of the Committee on the preamble should be deferred until the Bills of the Southwark and Vauxhall and West Middlesex Companies had been considered; Mr. Freeman strongly urging that this should be done, and Mr. Pember as strongly opposing it. The Committee decided that they would deal with each Bill on its merits in its order, leaving the question of the sinking fund only to be discussed afterwards.

Wednesday, July 11.

On the resumption of the proceedings this morning,

Mr. *A. R. Binnie*, M.Inst.C.E., Engineer-in-Chief to the London County Council, was examined by Mr. FREEMAN. He said that, being in the responsible position of an engineer who might have to carry out works for the supply of the Metropolis with water, he felt this position acutely. He did not in the slightest degree desire to restrict the Company in regard to what they required for their immediate necessities; but, basing his argument upon the evidence given before the Royal Commission, he contended that the works were unnecessary, as the promoters of the Bill had the largest storeage of any Water Company in London. Respecting the water from the wells, it did not require any storeage; being naturally stored in the chalk. He thought £40,000, instead of £80,000, would be sufficient for the pumping machinery for the wells.

Mr. *G. F. Deacon*, M.Inst.C.E., expressed the opinion that the expenditure of so large an amount as half a million was not necessary for the supply of the Company's district from year to year; and he did not think it reasonable, in view of the contemplated purchase, that the value of the undertaking should be so far enhanced by this expenditure.

Mr. FREEMAN then addressed the Committee for the County Council; urging that, while he did not object to the Company having sufficient powers for carrying out works for the next ten years' supply, if necessary, he asked their Lordships not to place upon the possible purchasers the obligation of permanent reservoirs, permanent works, and large authorized capital which might prove quite unnecessary when they came to deal with them, but to restrict the expenditure to such matters as were required for immediate necessities.

Mr. LITTLER, speaking for the Corporation of London, said that, subject to any extravagances which might be detected, that body held that the Companies themselves were the best judges of what was required, and that outside the County of London the Company had responsibilities which could not be ignored. The Corporation did not wish to affirm or deny the proposition that the Company ought to have the money they were seeking by the Bill; but they desired strongly to affirm the proposition that they ought to have such an amount as was reasonably proper for carrying on their works. The Corporation would only intervene so far as the question of the sinking fund was concerned. For the Corporation of West Ham, he would go a step farther, and say that they desired that the Bill should proceed, subject to certain modifications as to the method of levying the water-rates, which would be dealt with on clauses.

Mr. CRIPPS replied on behalf of the Company; pointing out that the simple issue was whether or not the Essex district should run the risks of a future water famine, and that all other considerations were entirely outside the question.

The Committee deliberated for a short time in private. On the re-admission of the parties,

The CHAIRMAN said that the Committee were of opinion that the preamble of the Bill should be passed.

Mr. LITTLER then, on behalf of the West Ham Corporation, brought up a clause, the object of which was to place the borough of West Ham in the same position as the Metropolis under the Torrens Act of 1885; making the assessment upon rateable instead of upon the annual value on rental.

Mr. *Eve* and Mr. *C. J. Piper* were examined in support of this proposition.

Mr. CRIPPS objected to the insertion of the clause, on the ground that it would be altering public legislation by a Private Act. The matter had been discussed several times before Committees of the House, and always adversely to the view put forward by West Ham.

Mr. BAGGALLAY having replied,

The CHAIRMAN stated that the Committee did not think it would be safe for them to interfere with the present system, or to alter the law as it stood. They therefore declined to entertain the proposal.

On Thursday and Friday, the Committee considered the West Middlesex and Southwark and Vauxhall Bills, the preambles of which were passed; the consideration of the clauses being postponed till yesterday, when the question of the sinking fund was to be dealt with. A report of these proceedings will be given next week.

LEGAL INTELLIGENCE.

SUPREME COURT OF JUDICATURE—COURT OF APPEAL.

Tuesday, July 10.

Before the MASTER OF THE ROLLS *and Lords Justices* KAY *and* SMITH.)

Chapman v. Fylde Water-Works Company.

This was an appeal from a judgment of Mr. Justice Day, after a trial before a jury at Salford, in April last,* whereby he held the defendants liable to pay to the plaintiff, Mrs. Chapman, £40 for damages sustained by her through falling over the cover of a stopcock affixed to a service-pipe conveying water from their mains at Blackpool to a house in the town. The jury found that the cover was in a defective state, owing to the negligence of the person or persons liable to keep it in repair; and his Lordship, on further consideration, held that the Company were liable.

Mr. J. SHIRESS WILL, Q.C., M.P., and Mr. H. W. HARPER appeared for the appellants; Mr. C. A. RUSSELL and Mr. W. WILLS represented the respondent.

Mr. SHIRESS WILL argued at some length that, the service-pipe and fittings, including the stopcock and cover, being the property of the occupier of the house, who had paid for them, the Water Company were not responsible for any defects which might arise therein.

Their LORDSHIPS pointed out that the Company alone had power to break up the streets for the purpose of effecting repairs; and they expressed the opinion that the stopcock was put in for the purposes of the Company as much as for the convenience of the occupier of the premises.

Mr. HARPER, in his argument, took the same points as his leader, and further suggested that the projection above the surface of the road of the cover of the stopcock, which was a lid working on a hinge, was owing to sand having found its way into it.

Their LORDSHIPS pointed out that the jury had found that the lid was defective, and that the appellants had not asked for a new trial.

The learned Counsel had not concluded his argument when the Court rose.

Wednesday, July 11.

On the resumption of the hearing this morning,

Mr. HARPER produced one of the stopcocks and covers as used at Blackpool, and, with the assistance of an official from the Company, explained its operation. Continuing his argument, he said the place where the accident occurred was not a street at the time the pipe and stopcock were fixed; and he contended that there was no obligation on the Company to keep these fittings in repair. It was the duty of the occupier to give notice of any defect; and the Company would then repair it at his expense.

Mr. RUSSELL, for the respondent, submitted that the statutes had given to the Company alone power either to put down the appliance in question in the first instance, or to repair it afterwards; and consequently, as an inference of law, there was imposed upon them the duty of keeping all the apparatus in such a condition as not to be a source of danger to persons using the street.

Mr. SHIRESS WILL, in reply, cited the case of *Glover v. The East London Water-Works Company* to show that the occupier had the power to repair such a service-pipe or fitting; and he submitted that the language of the Water-Works Clauses Acts also supported this view.

The MASTER of the ROLLS said he was of opinion that the judgment of the Court below was right; and that the fact of the appliance in question being in a public street imposed on the Company the obligation of keeping it in such a state of repair that it should not cause injury to anyone using the street. It was not necessary to decide whether the service-pipe was the property of the householder or of the Company. It might be assumed that the pipe, together with the stopcock and the iron casing, was the property of the householder; but this did not settle the question on whom lay the obligation of repairing it. By section 21 of the Company's Special Act, they were authorized to construct all necessary works and conveniences, and to maintain all the works, &c., required for supplying water. The East London Water Company's case seemed to show what was the meaning of the words "necessary for the supply of water," and that they included works necessary for preventing waste. By section 28 of the Water-Works Clauses Act of 1847, the undertakers had power to break up the streets and lay down pipes, &c., and from time to time to repair the same, and do all other acts necessary. The Special Act authorized the Company to put down this stopcock and casing, and to repair it; and the General Act authorized them to break up the streets for the purpose. No one else had a right to open the street to do repairs. If the occupier could not repair, it was idle to suppose that the law would say: "Because you have not done that which you cannot do, any person injured by your not having done it can maintain an action against you for negligence." He was of opinion that the stopcock was placed in its position primarily for the advantage of the Company; but assuming that it was also for the advantage of the consumer, this did not relieve the Company from the liability to keep it in repair.

Lord Justice KAY said the plaintiff in this case tripped against the lid of a guard placed over a stopcock in the service-pipe which led from the Company's main to a private house. She injured herself in so doing; and it was found by the jury that the hinge of the lid was out of repair, and that this was why it protruded and caused the accident. A similar guard had been produced, and it was apparent that it was much wider at the bottom than at the top, and that, when once it was fixed, it would be impossible to remove it without breaking up the surface of the street. Where the top was fixed in a hole made in a flagstone to receive it, the stone would have to be taken up before the stopcock could be removed. In order to repair the hinge, it would be necessary to remove it. The plaintiff brought an action against the Company, who, on a requisition from the occupier of the house, had themselves laid the service from the main to the premises, and of their own accord put in the stopcock, which could be turned by the hand if it could be reached. But it was fixed 2 ft. 6 in. below the surface of the street, according to their own bye-laws. Round the stopcock was built a square of brickwork, upon which the guard rested. The Company resisted the action on the ground that it was not their duty to repair the stopcock. By their Special Act, they had express power to lay down the service-pipe and to repair it; and by the General Act of 1847, which was incorporated with the Special Act, they had power to break up the street, not merely for the purpose of laying down the service, but also for repairing it. On that very section—the 28th—it was determined in the East London case that the placing of a guard like the one in question in a street was within the powers given to the Company by that section. He had looked in vain through the Act to find any express power given to the occupier of the house to which the service was laid to repair the service at all; and certainly there was no authority given to him to break up the street for the purpose. There were, beginning with section 48, certain powers conferred upon him to lay down and to take away the service-pipe; and under the 52nd section, for these two purposes, and for these only, as far as he could gather, the occupier had the right to break up the street. It seemed to him, therefore, that the only persons who had power to repair the guard (which could not be repaired without breaking up the street) were the Company. The Court had been referred to the Water-Works Clauses Act of 1863, by section 17 of which it was enacted that a penalty of £5 was to be imposed on anyone who wilfully or negligently allowed the pipes and other matters to be out of repair, or to be so used as to cause the water to be wasted. But most of the words in that section undoubtedly referred to things which were on the premises; and he should judge that the word "pipe" also had reference to a pipe within the house, and not to a pipe, valve, or cock in the public street, in order to repair which it would be necessary to open the street. Otherwise it would lead to this absurdity, that there was no power given to the occupier to break up the street in order to repair the guard or service-pipe, and yet he was liable to a penalty if he did not do it. Then section 19 of the same Act provided that it should not be lawful for the owner or occupier of any house supplied with water to affix any pipe or apparatus to a pipe belonging to the undertakers, or to make any alterations in the pipe or communication, without their consent. Therefore the owner here, whether the service-pipe and fittings belonged to him or not, had no power whatever to alter them without the consent of the Company. The result was that, if an action were brought against the occupier for not repairing this guard, the answer would be that he had no power to do it, or to interfere with it in any way, without the consent of the Company. Even if they gave their consent, he had no power to break up the street; and therefore there could not be an action for negligence against him for not doing that which he had no power to do. If there were negligence, someone must be liable; and he thought the party liable was the one in whom was vested the sole power of making the repairs, and of breaking up the street for the purpose—viz., the Water Company.

Lord Justice SMITH also delivered judgment to the same effect.

The appeal was therefore dismissed, with costs.

* See JOURNAL, Vol. LXIII., p. 813.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, July 11.

(*Before Mr. Justice* NORTH.)

West Surrey Water Company v. Guardians of the Poor of the Chertsey Union.

This action came before the Court for the determination of certain points of law which arose upon the following statement of facts: The defendants are constructing certain works for the purpose of draining and disposing of the sewage of Weybridge and the special drainage district of Oatlands; the whole of such works being within the limits for the supply of water by the plaintiff Company. As part of such works, the defendants have constructed a large tank, in order that into it might flow by gravitation, through the sewers, the sewage of the parish and district. They were also erecting condensing steam-engines to work pumps to force the sewage from the tank to the sewage-disposal works situated near Byfleet. Since the issue of the writ, the defendants had constructed a well or chamber, 4 feet wide, 7 feet long, and 13 feet deep; and water from the River Thames would flow by gravitation through a 6-inch pipe into it—the defendants having entered into an agreement with the Conservators of the Thames, by virtue of which that body, in consideration of the annual payment of £2, agreed to grant permission (during pleasure) to the defendants to lay down a 6-inch suction-pipe under the towing-path near Weybridge Lane, with a "rose," extending beyond the face of the river bank, for the purpose of drawing a supply of water for the sewage works. The defendants intended to affix to the steam-engines a pump or pumps to raise water from the well or chamber for the purpose of supplying water to the condensers of the engines, and for flushing the sewers in their district; and their idea was to use some 30,000 gallons a day for the condensers, and about a similar quantity for flushing the sewers. The defendants were constructing 16 automatic flushing chambers, each situated at a higher level than the well or chamber; the highest being 154 feet above Ordnance datum, and level with the sewer at this point. Of these chambers, one had a capacity of 500 gallons; another, a capacity of 750 gallons; four, a capacity of 1000 gallons each; seven, a capacity of 1500 gallons each; one, a capacity of 3000 gallons; and two, a capacity of 5000 gallons—making altogether 28,750 gallons. The defendants had laid or were now laying about three miles of iron water-pipes, generally in the same trench, and at the same depth, as the sewers, to convey water to the chambers. In these pipes the defendants had fixed, at the bottom of the manholes, about 115 special flushing-valves, which were to be connected with the sewers, and used for flushing them. At the sewage-disposal works, the defendants were erecting steam-engines and a pump. They were also constructing a well, and intended therewith to pump water to be used in supplying the engines and for treating the sewage, for which purpose they would also utilize rain water. The water the

defendants proposed to use would be unfiltered. The questions for the decision of the Court were: (1) Whether the works, or some of them constructed, or proposed to be constructed, by the defendants were water-works within the meaning of the Public Health Act, 1875. (2) Whether the proposed dealing by the defendants with the water was a "supply of water;" and whether the works, or the proposed works, were for "supplying or used for supplying water," in contravention of the provisions of the Public Health Act. (3) Whether the defendants had the right to take, pump up, store, and distribute, by way of pipes and otherwise, such water as they might require for their own use and for the purpose of their condensing-engines, and for flushing the sewers in the parish and district.

Mr. COZENS-HARDY, Q.C., and Mr. MULLIGAN appeared or the plaintiffs; Mr. SWINFEN EADY, Q.C., and Mr. GORE-BROWN represented the defendants.

Justice NORTH, in delivering judgment, said he thought the plaintiffs had mistaken their rights. They had legal duties cast upon them to supply water within their district; and from the sections of the Act, it appeared that they were bound to supply such water as might be necessary for the purpose of flushing sewers, just as, in the same way, they were liable to supply any inhabitant in the district with water for the service of his house; but there was no corresponding obligation cast upon the persons whom the Company were bound to supply with water necessarily to take water for the purpose. Any inhabitant in the district might sink a well in his garden, and put a pump into it, and so supply his house. He (Justice North) had not heard any reason suggested why such a person could not supply his neighbours if he pleased, provided that he did not establish a water-works within the meaning of the Act. The plaintiffs' case rested solely upon this—that the works in question were water-works within the meaning of the Act, which the defendants had no right to erect without having first given the plaintiffs the option of supplying water, which they stated they were ready and willing to do. The answer to this was that, though the defendants wanted water, they did not need the filtered article which the plaintiffs had for sale. It was their duty to obtain water, for the purposes for which it was required, in the cheapest way, in order to lessen the burden upon the ratepayers. The best method of doing this was for the defendants to draw water from the Thames, which they had obtained leave to do, as they could by this means procure it much more cheaply than if they had a supply of filtered water from the plaintiffs. The only question was whether, in so taking this water, they were infringing the rights of the plaintiffs under the Public Health Act, as it was admitted that the Special Act of the Company did not prevent the defendants from doing what they proposed to do. The defendants were not constructing water-works to supply the district for public and private purposes; they were only putting into the sewers, which were their own property, the water necessary to flush them. He could not understand how it could be said that taking water from the Thames for their own purpose was "supplying water" in the sense in which this term was used in the Act. The 56th section of the Act stated that a local authority should provide and keep in the water-works constructed by them a supply of pure and wholesome water; and it was contended that, under this section, the water employed for cleansing the sewers must necessarily be of the same high quality as that supplied to householders for domestic consumption. In his opinion, however, it would be absurd to suppose that it was necessary for the defendants not to use for the purpose of their works any water except that which was pure and wholesome. There was nothing in the Act which would prevent the defendants from doing what they had done, or were proposing to do; and, accordingly, the first and second questions would be answered in the negative, and the third in the affirmative.

It being agreed that the decision upon the points of law substantially disposed of the whole case, the action was dismissed with costs.

SURREY QUARTER ASSIZES, KINGSTON.—Friday, July 6.

(*Before Mr.* HENRY YOOL *and other Justices.*)

The Redhill Gas Company v. The Reigate Union Assessment Committee.

This was an appeal by the Redhill Gas Company against the rating of their property in the parishes of Reigate and Nutfield.

Mr. E. BOYLE appeared for the appellants; Mr. BALFOUR BROWNE, Q.C., and Mr. MUIR, for the respondents.

Mr. BOYLE, in opening the case, said that the Redhill Gas Company's works were situated in the parish of Reigate; and they had pipes in the parishes of Nutfield, Merstham, Bletchingley, and Gatton. The appeal was against the gross and rateable value in the parishes of Reigate and Nutfield; the rate having been made on April 28 last. The gross value in the old list for the Reigate parish was £3281; and the rateable value, £2412. The new rate was £4200 gross, and £3200 rateable. Roughly speaking, this was an increase of between 30 and 40 per cent. on the rateable value; while in the parish of Nutfield, the increase had been from £32 to £100, or 200 per cent. Early in this year, Mr. Jones was called in by the Assessment Committee to make a valuation of the Company's property; and he valued the premises at £4926 gross and £3926 rateable. The Company objected against this to the Assessment Committee, who reduced the figures by £726—leaving them, as they now appeared in the list, at £4200 gross and £3200 rateable. After this reduction, his clients met Mr. Jones with the view of disclosing their figures to each other, and in order to show the reasonableness of coming to some fair assessment of the property. He was sorry to say that the meeting was unsuccessful; Mr. Jones not being disposed to exchange with them the figures upon which the calculations were based. There was one matter he should like to allude to very briefly. Mr. Jones was the Surveyor appointed by the Assessment Committee; and he was paid by results—the Committee having passed a minute that his remuneration was to be 1¼ per cent. on the amount of his valuation, as approved by the Committee. The appellants objected to this method of payment. They contended that, instead of Mr. Jones being an uninterested party, he was distinctly interested in the amount of the assessment, because he was not paid even when that Court or a higher Court had decided what was the fair rateable value; but he was paid when the Assessment Committee approved of his figures. The higher he could put his figures, of course the more remuneration he received. He (learned Counsel) did not wish to press this point unduly; but his clients could not help feeling that this affected them to some extent. In 1883, the net profits from the works amounted to £3917. In the following year, Mr. Jones, was called in to make a valuation of the rateable value of these premises; and he then fixed it at £2412. In 1893, the profits were practically the same as in 1883; and yet, instead of fixing the rateable value at £2412, he put it up to £3927. Referring to the condition of the works, the learned Counsel said they were built on a bog, which had given them a great deal of trouble. The premises showed all over a dilapidated condition; and there were settlements in every building—the premises, in fact, had not been kept up in the state they ought to have been; and, at the present time, they required considerable outlay upon them. He could not deny that the valuation of gas property must be of a very intricate character. The accounts of a gas company assisted, to a considerable extent, in arriving at what the rateable value should be; but they were not altogether the foundation of the rateable value. A tenant going into the property would have to consider what he could afford to pay for it, and what he ought to expend upon it to repair and maintain it, to keep it in a state to command the rent. He thought that the evidence he should call would show that they had been unduly assessed.

Mr. *John Lees*, Fellow of the Surveyors' Institution, and Chairman of the appellant Company, was the first witness. He stated that the greater part of the works was built on bog land, which varied in depth from 2 feet to 18 feet; and it was water-logged to about 3 feet of the surface. This was a very bad foundation for the works; and consequently the premises and the apparatus contained a number of defects. The meter-house and board-room had settled very seriously, although the former was built only about eleven years ago. The retort-house was put up some 20 years ago upon 18 feet of solid concrete; and in spite of this, there were cracks in the wall. The chimney-shaft was also fractured. His valuation had been made on the lines laid down in the case of *Reg. v. The Overseers of Lee*. He made the rateable value in all the parishes £1993; and the gross value of the station, £2391. He had arrived at his figures on an average of three years. The average of the receipts for gas-rental, meter-rents, residuals, &c., over three years was £13,856; and the working expenses, £8213. To the latter figure he had added rates at 4s. 3d. in the pound in Reigate and 2s. on (say) £100 on mains out of Reigate, £414—making the total expenses £8627. These figures showed that the net receipts were £5229. With regard to the occupier's share, he had allowed £2000 capital for 2000 tons of coal; and he did not think this was too much for safety. Roundly, their coal last year cost them 17s. 3d. per ton. He had taken five-twelfths of the average of three years' expenses as working capital, £3975. He had taken the present value of the meters at £2027; and the tools and furniture as per an inventory (which witness put in), £620. The 1893 account showed that the net profit was £4085; and the balance of profit in the 1883 account was £3917. His figures were taken from the accounts, with few exceptions. Law costs he had put down at £100; but happily they had not had any for some years. In 1893, the repairing of meters only cost £6; but this was manifestly insufficient to keep £2000 worth in order. He had therefore calculated that an equitable amount for meter repairs and renewals would be £162. The number of meters in use was 886, varying from 3 to 300 lights. He took the cost of the meters from the books; and found that the outlay for the ordinary ones was £1772, and for the station meter £250. He had calculated that the buildings would require to be replaced every 50 years; and the annual sinking fund to reproduce them, on the 3 per cent. tables, would be 0·0088 per cent., or equivalent to £92 a year. With respect to the apparatus, the very risky part of the structure he had taken at 25 years; and the sinking fund to reproduce the amount of £15,605, on the 3 per cent. tables, would be 0·0274 per cent., or £428 per annum. Regarding the mains, which were laid in various soils, he had taken 30 years as the life; and the sinking fund would be 0·0210 per cent., or £121. This was in accordance with the Lee case.

In cross-examination by Mr. MUIR, witness said the business of the Company was steadily increasing. Asked why, if this was so, he had taken the averages of the past three years, he said he thought that was the fairer way of making his calculations than going upon a hypothetical business. The gross receipts on the average of the three years were £13,856; and last year they were £13,994. He explained that these figures included the money paid by the Corporation of Reigate for lighting, cleaning, and extinguishing lamps. In 1891, they paid for coal, 19s. 4d. per ton; in 1892, 17s. 6d.; and in 1893, 17s. 3d. They had two contracts running now—one at 13s. 9d. per ton, and the other at 12s. 3d. He estimated the cost of tipping and unloading the coal at 5½d. per ton. He believed the last law expenses were incurred in 1868, in connection with an arbitration respecting the erection of a gasholder. He admitted that in the years 1891-4 he signed the reports which were submitted to the shareholders, and in which it was stated that the buildings and plant had been efficiently maintained. He did not now say that the buildings were in a ruinous condition; but that there were serious cracks in several of them. It was impossible to keep them in the same condition as they were in when built. Reverting to the question of the cost of unloading coal, witness said he had nothing to do with the books; but if there was an entry for December, 1893, to the effect that the cost of unloading 900 tons was at the rate of 2d. a ton, he had no doubt that referred to the three stores immediately under the railway. The amount he was charging for renewals and repairs was £1689—that was on an average of five years.

Mr. MUIR: I see that in the five years £4518 was actually spent on the buildings, and £626 for mains. The average of that is £1028 and a fraction; while you are charging £1689.

Witness, in further cross-examination, explained what he considered to be the difference between a reproduction and a renewal. With reference to tenant's capital, he was asked whether, having allowed the tenant 2000 tons of coal, and then five-twelfths of the year's expenses beyond, that was not charging the same thing twice over. Witness replied that it would be five months before a tenant entering

the premises would receive any return; and he must keep in hand a stock of coal for carrying on the business. Their gas accounts were rendered quarterly; and during the three months they were not receiving money for residuals every day. They only made sulphate about once every six weeks or two months; and coke they sold nearly every day, but mostly on credit. The coal delivered one month was accounted for the next.

Mr. MUIR: The effect of that would be to make the five-twelfths, six-twelfths.

Witness: The coal delivered one month is paid for next pay-day.

The terms of payment, according to your contract, are that the account is to be delivered by the 15th of the month following the delivery of the coal, and due at the next meeting of the Directors on the first Friday of the ensuing month. I suggest that is two months' credit?—The account is sent off by the factor the moment the coal is loaded; and, if it be in time, it is paid the next pay-day.

Mr. YOOL: It seems to me that if coal is delivered on the 13th of the month, the bill can be sent in on the 15th; and we shall go by what the witness says is their practice in this respect.

Mr. MUIR: Witness maintains that he is to have five-twelfths of the goods required beforehand; so that the question is really important as to when they are to pay. If he has not to pay till two months or six weeks after delivery, it makes a material difference in the five-twelfths. What they chose to do at the present time would not bind the hypothetical tenant.

Cross-examination continued: In 1893 they paid £5749 for coal, or 17s. 3d. per ton. Coal was increasing in price; so that he thought £1 per ton was a reasonable figure to take.

Mr. MUIR: Five-twelfths of the actual money paid for coal last year would be £2400; and adding to that 2000 tons at £1 per ton would make £4400 for tenant's capital for coal alone, while you only paid £5749 for the whole year.

Witness said he had not worked the figures out; and perhaps Mr. Muir was correct. In answer to a further question, he stated that there were seven Directors, whose total remuneration was £500.

Re-examined: The coal was hauled from the station at the cost of 1½d. per ton; and this, with 2d. for unloading, would make 3½d. per ton. The figure of 5½d. might apply to the extreme end of the coal-stores. Really, 2000 tons of coal was not a safe quantity for them to hold. Owing to the railway charges having been raised, they were driven to get the coal by sea; and there was considerable interruption of traffic in foggy weather.

Mr. *G. Humphreys-Davies*, Fellow of the Surveyors' Institution, and Surveyor to The Gaslight and Coke Company, deposed that he had been over the appellants' premises; and he found that the works generally, while not exactly in a bad state, had suffered very much from the bad foundation upon which they stood. The largest holder from the first had been in a crippled condition; and the tank of the second holder was fractured and had been repaired. It might last some time yet; and it might give way almost directly. The smallest holder required renewing at once. The retort-house had suffered considerably from the bad foundations; and regarding the building in which the Board-room was, the settlement there had been so great that the ends of the purlins had been drawn out of the walls. On a site such as this, the expenses for repairs and renewals must be larger than under ordinary circumstances. There were 10 to 12 feet of bog under the works; and a brook ran through them. The most serious part was the condition of the two large holders. In the endeavour to stop the settlement, the Company had put up a retaining wall; but this had now dropped some 6 or 8 inches below the level at which it was originally built. Examined as to his valuation, he said that it showed a gross value for the station and mains in the Reigate parish of £3454, and a net value of £1889; while for the Nutfield parish the figures were £50 gross, and £40 net. Having considered the whole circumstances carefully—the history of the Company and its present state, which was a most important thing—the above, in his opinion, was a fair valuation. Of the net rateable value of £1889, £1054 was for the station, and £835 for mains. In making his calculations, he had taken an average of three years. The receipts and expenditure had been placed at their actual figures, with the exception of two items. He found that the repairs and renewals of meters were absurdly low—that a tenant would not be able to maintain them for the amount charged; and as a Company could never tell when it would incur law charges, he had put down £100 under that head. He placed the life of meters (if they were not repaired) at ten years. The net average annual income came to £5642. As to the occupier's share, he had taken £2000 for the stock of coal, which was very moderate; the stock having to be larger at the present time owing to labour troubles. The usual calculation now for the stock of coal was about 70 days' maximum consumption. The Gaslight and Coke Company were largely increasing their coal storeage room. For additional storeage for the Nine Elms works alone they had to purchase a piece of land which cost £50,000 with compensation, This was an expense that would not have had to be incurred under the old order of things. Resuming his evidence as to the occupier's share, he said he had taken meters at £2027, including £250 for the station meter. Stores, chattels, furniture, tools, &c., he put at £656; coke, breeze, sulphate, tar, &c., in stock, at £173; and residuals in stock, at £670. He had allowed five-twelfths of the working expenses, *plus* rates, which made a total of £9118 for tenant's capital. In his experience, five-twelfths was the proper amount; it was allowed in the Lee case. He had taken that capital (£9118) at 17½ per cent.—5 per cent. for interest; 10 per cent. for trade profit; and 2½ per cent. for risks to tenant's capital, which made together £1596. He allowed 8d. in the pound for income-tax, because he considered that a tenant would require to get out of the undertaking whatever taxes he had to pay. The gross annual rental of the works and mains, *plus* rates, was £3993. Then, as to statutory deductions, it was clear that in some cases, the charges had been entirely inadequate in the past for the maintenance of the hereditament. The time was closely approaching when the two largest holders would have to be renewed; and no provision had been made for this in the accounts. The same remark applied to other parts of the works which were wearing out. The value of the works in their present condition was not now equal to what their original cost was; and the deficit must be made up out of income. He had provided for sinking funds based upon his experience; and he had taken the probable life of the various parts of the undertaking at exactly the same numbers of years as Mr. Lees had done. If they took the total he had included in that way, added to what the Company had already spent, he found, by referring to the experience of other companies, that it—judged either by the length of main, or by the gas sold, or by the coal carbonized—was a reasonable sum. The figures totalled to £1592; and this gave him a net annual value, including rates, of £2401 for the whole undertaking. He made the value of the station £26,100; but as there were only 77 retorts in use out of 98, he had taken the station valuation at £20,482. Five per cent. on this, gave a net annual value of £1024; and £30 for land made £1054. The rates upon this, at 4s. 3d. in the pound (which appeared to be the proper amount for the ensuing year), made up a deduction of £1297 for the station, and left £1122 as the rateable value of all mains in all parishes, including rates. The rateable value of the dead main in Gatton was agreed at £6. He put the rates there at 2s. in the pound, which made a deduction of £7; giving for the other parishes, £1115 as the rateable value of all live mains including rates. Turning to the apportionment of the rateable value, the total gas receipts in the various parishes was £10,765; and the £1115 he apportioned among the various parishes *pro ratâ* according to the gas receipts. The receipts in the parish of Reigate were £9771. Therefore, as £10,765 was to £1115, so was £9771 to £835. The rates thereon at 4s. 3d. in the pound would be £177. The figures for the other parishes made the total rateable value of the live mains £928, and the rates thereon £186; and this gave him £1114. His total net valuation for Reigate parish was £1889, as against £3200; and for Nutfield £40, against £100.

In cross-examination, witness stated that the last rating appeal of The Gaslight and Coke Company occurred before his appointment as their Surveyor.

Mr. BALFOUR BROWNE: I find from your statement that many of the meters have been in use for some 25 years; that does not look as though they die out in ten years.

Witness: Certainly not, because those meters have been repaired.

Admitting that the meters require repairing, are you aware that the repairs have been paid for out of revenue?—They have not; they have not been maintained.

Mr. BALFOUR BROWNE: What! the meters that have been in existence since 1869 have not been maintained?

Mr. YOOL: Is it reasonable, Mr. Browne, that 886 meters can be kept in repair for £5 7s. 2d. a year.?

Cross-examination continued: He had taken the average receipts for the past three years at £13,851; while the revenue last year was £13,991. His attention was called to the fact that last year there was a large increase in the income as compared with 1883; but he showed that, although a larger business was being done—the price of gas having been reduced, and the expenses being greater—the profit was practically the same. He thought it was fair to take the current rate of 4s. 3d. in the pound rather than the average of the past three years.

Mr. BALFOUR BROWNE: You ought to take the accounts for the current year if you are going to take the current rates.

Mr. *J. Hepworth*, Gas and Water Engineer to the Carlisle Corporation, said he had made a careful valuation of the works. He arrived at the figure of £1999, less the manager's and the foreman's house, which were rated separately. He deducted £35 for these—making the rateable value £1964; and this was the most that a hypothetical tenant would pay for the premises and mains. With regard to the necessity for a stock of 2000 tons of coal, in his opinion that was barely sufficient to carry the works on for ten weeks; and, after the experience of last year, it was unsafe to go below a ten weeks' stock. He considered that 2400 tons ought to be kept in stock; and this would serve the Company for ten weeks in the winter. As to repairs and renewals, the Company apparently had not been spending the amount they ought to have done. Last year they expended about £1180 in all for repairs and maintenance. If they had spent 5d. per 1000 cubic feet of gas sold, it would have amounted to £1231, which would have been an exceedingly moderate sum. As a proof of this, the London Gas Companies and some of the suburban companies spent 5·99d. per 1000 cubic feet. It ought always to work out in a concern like the Redhill Company to a larger amount per 1000 cubic feet than in London, where the consumption per mile of main was much greater. As to renewals, the amounts that had already been discussed were about the sums he should have suggested. But he found that, if they allowed 5d. per 1000 cubic feet for repairs and maintenance; and something like 2¼d. or 2½d. for renewals, they then had a safe amount for any company to work with. The quantity of gas sold by the Redhill Gas Company last year was 59,119,000 cubic feet.

By Mr. YOOL: They ought to have spent £1230 on repairs and maintenance last year, instead of £1180; and for renewals they ought to have set aside £650.

Cross-examined by Mr. BALFOUR BROWNE: In making his calculations, he had taken the last year only; and he thought this was the safest principle to adopt. He did not think that allowing five-twelfths of the working expenses for floating capital, *plus* £2000 for coal, was excessive. Some of the figures which he had quoted were taken from Field's "Analysis;" and the 5·99d. for repairs and maintenance was an average. Of course, some were higher and some lower. At Carlisle he had expended 5·35d.

Mr. BALFOUR BROWNE: At Hornsey, the wear and tear charges are 2·62d., and distribution 1·93d., or together about 4½d.; so that there are some companies who manage with less than 5·9d.

Witness: I do not think they can do so prudently.

Re-examined: The figure for the Commercial Gas Company was 6d.; and, in one instance, he believed it was 8d. The Redhill Gas-Works, being built on a bog, were more expensive to maintain; it was one of the most wretched foundations he had ever seen.

This concluded the evidence for the appellants.

Mr. BALFOUR BROWNE, in addressing the Court, said that, when they had a gas company to value, the company, of course, took the worst possible view of their affairs. Mr. Hepworth said (and he thought wisely) that the right way to value a gas-works was upon the receipts and expenses of the last year. That was the best evidence, because, if they took the average of a number of years, of course they

got certain elements that would have passed away altogether. The witnesses he should put before the Court had taken the receipts and expenditure of the last year. He did not say this was absolutely conclusive. Of course, it was quite possible there might be fluctuations in one particular year which might have to be considered; but if the last year was fairly representative, that would show what a tenant might expect to meet with in the next year. Turning to the question of receipts and expenditure, he said that he came to a very debateable point as to the question of renewals. The Court would have evidence that the representatives of the Company had taken too large an amount. He thought the Bench would lean to him when he said that the Company had been fairly doing their duty; they had not been skimping their works so much as they would have the Court believe. The Chairman of the Company told the shareholders in his reports that the works had been efficiently maintained; and it would have been wrong of the Directors—he would not impute it to them—to skimp the works in the way the expert witnesses had tried to make out they had done. There was no doubt the works were built upon bad land; but this had been allowed for in the valuation of the works by his witnesses. He thought the Company were asking for a little too much when they put down five-twelfths of the working expenses to cover stores, and £2000 for coal besides. It seemed to him that all they now had to do was to fight upon the points of differences, which were comparatively few.

Mr. *C. F. Jones* was the first witness for the respondents. He thought the accounts for the last year were the best to work upon, having regard to the fact that the rate was made for the ensuing period. He did not think they need fear any trouble for some time in the English coal trade; seeing that the funds of the Unions were exhausted, and that they had a Conciliation Board, and Lord Rosebery's agreement. As to his valuation, he made the present capital value of the Redhill gas-works £26,011. In his opinion, a tenant would get a larger amount of revenue in the ensuing year than in the past one, as the gas receipts were an increasing sum. The total receipts for last year were £13,990. As to the expenditure, he had taken 6474 tons of coal at 14s. 3d., which was rather high, as the running contracts were at 12s. 3d. and 13s. 9d.; and that made £4617, as against £5749 last year. Cannel he had placed at £205; purifying materials, at £53; and wages on the works, at £807—making £5678. For tenant's repairs and renewals of meters, he took the average of the past three years, as only £5 was debited last year, and this gave him £71. The other figures had been taken from the accounts, excepting the item of law charges, for which he had allowed £20. This made the total working expenditure £6749; leaving the net receipts, excluding rates, at £7241. With regard to the occupier's share, he had worked out the value of the meters, when new, from a trade catalogue, with the usual discounts, at £1575 7s. 3d. He had reckoned that the meters had depreciated in value by one-third; and he deducted £513 for this—leaving the present value at £1061. The depreciated value of the gas-stoves he placed at £107, which made for meters and stoves together £1168. With regard to tools and chattels, he found that, as a rule, 1s. per ton of coal carbonized was a fair amount to take; and this equalled £330. Coke, breeze, sulphate, tar, &c., in stock, he placed at £173. Then, as to coal, he admitted that a tenant should have in stock, as a rule, six weeks' supply and no more. The cost of coal for 1893 was £5749 for 6474 tons. The former figure, divided by the latter, equalled 17s. 3¾d. per ton. With the price of coal at 14s. 3d. per ton, the cost would be £4613, and adding cannel £205, made £4818. Six weeks of this would be equal to £556, which a tenant would require to have in hand on Dec. 31 for the stock of coal. As delivery was constantly going on, he would have another six weeks' supply in hand before the first was exhausted. The tenant's working expenses, *minus* rates, equalled £6749. The gas being supplied a quarter in advance, 1½ months were needed for collection; so that the tenant required 4½ months' working expenses in hand, which amounted to £2531. The tenant would thus have about £2300 for coal in the 4½ months; his expenditure for coal for the year being £4818. Beyond what he had calculated, the tenant would be receiving money for coke and other residuals and prepayments for gas during that period. He had treated the residuals sales on the same basis of 4½ months; and the cash the tenant would require for rates would be £132. In order to give the tenant a percentage sufficient to induce him to carry on the works, he allowed him £4000 as the amount required on going into the works.

Mr. Balfour Browne: And you have taken one-quarter of that to cover the interest, risk, profit, and fees.

Witness: I allow £1000 as an inducement to the tenant to become the tenant and to guarantee the rental. The gross rental is £6241, *plus* rates.

Examination continued: In 1893, an amount of £1122 was charged for repairs and maintenance; whereas in the three previous years, the figures were, £619, £651, and £675. He therefore came to the conclusion that in the £1122, there was a sum included which was not properly chargeable to revenue; and there was a sum of £600 which was a renewal, and should have been spread over some years. The average was £826. There was nothing down in the accounts for insurance; and they were entitled to a deduction for such portions as would be insured in practice. Those he estimated at about £9000; and this made for insurance, at 3s. 6d. per cent., £16. This gave them £842 as the landlord's annual costs. He had therefore allowed £1000. Deducting this from the £6241, left the rateable value of the whole concern, *plus* rates, at £5241. He made the total structural value of the works £26,000; and the value of the site, at £1000 per acre £1800—together £27,800. Taking 4 per cent. on this, or £1112, and adding the rates payable thereon at 4s. in the pound (which was the actual figure) £222, made £1334; and it left the rateable value at £3935. They had therefore a margin of £700 above the £3200.

In cross-examination, witness was asked why, with a property valued at £26,000, he would only insure it at £9000; and he replied that he would not insure the gasholder tanks, nor the retort-house, the roof of which was built of iron, and consequently the risk would be very small. Questioned as to his remuneration, he admitted that he had been paid the 1¼ per cent. commission on the valuation of £3200. On the subject of the cost of coal, he still maintained he was correct in taking the price of the current contract, as an incoming tenant would be entitled to it; and also that the £556 he had provided for coal was sufficient to allow the tenant on the average of the year through, seeing that he had, in addition, 4½ months' working expenses.

Mr. Yool: I do not think you have made adequate provision for coal.

Cross-examination continued: Witness said he valued the works in 1883. The receipts were then £10,332; while in 1893 they were £13,990. The profits, he was aware, were about the same. In 1883, he allowed a tenant's capital of £6000. But he did not, as a matter of fact, deduct any sum for the residuals that would come in during the first three months; and, in consequence, he allowed too much.

Mr. *W. A. M. Valon*, Gas and Water Engineer to the Ramsgate Corporation, said he had inspected the Redhill Gas-Works, with the view of ascertaining the rateable value. He had proceeded upon the accounts for 1893; and the receipts were £13,990, and the expenditure £6749—leaving the net receipts at £7241. He had taken the absolute number of tons of coal and cannel carbonized—viz., 6643. Then taking the existing contracts as a basis, but allowing rather more—14s. 3d. per ton—6474 tons of coal amounted to £4613, and 169 tons of cannel, at 24s. 3d., to £205. This included delivery into the works, and totalled to £4818. In the commencement of the year, there was a strike, and the prices and freights on coal ran up to an abnormal figure; but it was only a casual thing, and was not likely to occur very often. He considered that, in trying a valuation of this kind, the price of coal should be looked at in the future, whether it was to be more or less than in the past. In addition to the other items appearing in the expenditure for 1893, he had made an allowance of £20 for law expenses. As to tenant's capital, he had taken the stoves at £108; and adding to that what he regarded as the true value of the meters made £1156.

Mr. Yool: In fact, your valuation practically agrees with that of the previous witness.

Witness: Yes. In further examination, he said he had allowed the tenant 4½ months' of the total working expenses of the year, deducting 4½ months' receipts for residuals; and this he considered would be sufficient for a tenant going in. The total working capital he allowed was £1674; and £4038 was the total tenant's capital. He might say that, taking 1890, 91, and 92, the appellants' costs per ton of coal for repairs and maintenance were 2s. 11·48d., 2s. 8·06d., and 2s. 10·25d. respectively. In 1893, they ran up to 3s. 6·28d., which made the average for the four years 3s. 0·22d. He made the total rateable value £4822. His allowance for repairs and renewals was £1052, which was rather more than the average.

Mr. Boyle: Taking the average, you have allowed 3s. 2d.; but taking the average in Field's "Analysis," it would come to 4s. 3d.?

Witness said he might admit at once that averages taken from Field's or any other analysis were misleading, unless they were dealing with works that were on all-fours with those to which the averages applied. He made the total working expenses £6749, which, he was aware, was considerably less than was shown in the Company's accounts; but that was because he dealt with coal prospectively, instead of taking the prices paid in the past.

Mr. *R. W. Hedley* gave evidence as to the cash paid by the Company into their bankers at certain dates; and he afterwards agreed that six weeks' stock of coal and 4½ months' of the total receipts was a liberal allowance. With regard to repairs and renewals, he had gone back in the Company's accounts for eight years; and he found that it cost for works alone 31·41d. per ton of coal carbonized, and for mains 4·93d.—making practically 3s. per ton. This included all repairs that had been done. Allowing 3s. per ton, brought out a figure close to that Mr. Jones had given; and this was quite sufficient.

Mr. *W. Eve* said he found that the repairs and renewal of works, plant, mains, pipes, and meters cost, on an average of four years, 3s. 3d. per ton of coal carbonized; and this worked out, taking 6643 tons of coal, to £1079. He had allowed £1100 as the tenant's share. Asked whether this would be sufficient for carrying on the works, and paying a rent of £4600, he said it would, less the small amount that would have to be paid by way of rates on any higher assessment than the present rateable value of £3496. This included what was in and out of the Union. He had calculated the coal at 14s. per ton; but 13s. 7d. was the actual amount that had been paid in January, February, and March.

Cross-examined: The land on which the works were built was very boggy; and the buildings were cracked all over through settlements, but they could easily be stopped. The supports round the gasholders were made right last year. About £2150 was spent in increasing the capacity of the holders, and putting in new guides.

Mr. Balfour Browne thought the Bench would come to the conclusion that the best guide of the value of this undertaking was what the Company had themselves done. He would ask them to believe that the works had been very well managed, and that the Company had done well. The only thing which occurred to him to speak about was as to whether Mr. Jones had allowed sufficient for coal. Last year coal cost £5749; and Mr. Jones had allowed £4818. Was that too little? If they took £560 for six weeks' allowance and 4½ months' expenses, that gave them sufficient for half of the whole year's coal. He asked that the appeal should not be allowed.

Mr. Boyle also briefly addressed the Court. He remarked that all the valuers he had called had taken the accounts as they actually stood; but had, in addition, only added a sinking fund for the renewal of the premises at the expiration of a given time. His first point was that in 1893, they made a profit of £4085; and was it to be believed, as suggested by the surveyors called on the part of the respondents, that a tenant was to be found who would be willing to work the premises and pay the whole of the profit in rent? The Bench must not pay any attention to a gentleman who blew hot and cold, and valued these premises at two widely different amounts at times when they were making practically the same profit. In 1883, Mr. Jones put the rateable value at £2400; and now they were doing a great deal more work in order to make the same money, he put them up to £3200, or something like 40 per cent. He referred to the figure of £1100 Mr. Eve had allowed the tenant for capital as ridiculous; and then he pointed out that the Reigate Gas Company, with half the capital of the Redhill Company, had been assessed at only £1200. Why the Redhill Company should be singled out, and punished by having their assessment raised to £3200, was very extraordinary. He wished to

accentuate the fact that they would never have come to the Court unless they had been compelled to. It was a terrible thing for a little Company like theirs to fight an all-powerful Assessment Committee, who practically fought them out of their own funds, seeing that they were large ratepayers.

Mr. Yool, in giving his decision, said the Court felt that the Company, in the statement they had put forward, had endeavoured to make certain deductions that did not come within the strict letter of the law. At all events, he thought the allowances they claimed were too large. Nevertheless they made it appear clear that the state of the works was such that the expenses of ordinary repairs and a fair allowance for renewals would be rather more than they would be in works built on a thoroughly good foundation. He was satisfied that the amount which had been charged against revenue had not been sufficient to maintain the works in a state of efficiency. The gasholders, there was no doubt, would require to be renewed after a time. He confessed that he was very much impressed with the fact that Mr. Jones did not make an adequate allowance in respect of coal—that he did not provide such a stock of coal as a prudent manager would be entitled to hold in view of the circumstances of last year. The decision of the Court was that the gross assessment in Reigate should be £3500, and the net £2500; and in Nutfield, the gross £130, and the net £90. The appeal would therefore be allowed, with costs.

Oldham Corporation Water-Works Extensions.—The enlargement of the Ogden reservoir of the Oldham Corporation has been completed. It is now 31¼ acres in area, and is capable of containing 184,500,000 gallons. The Water Committee have lately decided to purchase the Dowry estate—consisting of 55 acres of land—for extension purposes, for £8300; and, at their last meeting, the Council passed a minute of the Committee to the effect that the construction of the Rooden reservoir should be forthwith commenced. The cost of this, it was stated, will be small; but its capacity will be considerable.

The Bodmin Town Council and the Gas Company's Charge for Lighting.—At the last meeting of the Bodmin Town Council, the Lighting Committee reported that they had considered the question of the cost of lighting the town, and had sent circulars to other towns in Cornwall and Devon inviting information. Mr. Roscorla considered that the amount now paid for street lighting was exorbitant. It amounted to one-eighth part of the Corporation's income; and this was too much to spend on one item. He moved that the Gas Company be offered £243 10s. in settlement of their claim to the end of next August. This amount, he explained, was arrived at by a calculation of a consumption of 9000 cubic feet of gas per lamp, at a cost of 3s. 7d. per 1000 cubic feet. The Town Clerk said the amount suggested by Mr. Roscorla was £31 less than the contract price. Alderman J. M. H. Cardell said the figures mentioned by Mr. Roscorla were not accurate. It was true that he had given these at a previous meeting, when misleading comparisons were being suggested; but a reference to the Company's books had shown that the consumption of gas was more than 9000 cubic feet per lamp. A proposal to defer consideration of the question until information was received from other towns was defeated; and the motion of Mr. Roscorla was carried.

The Abolition of Gas-Meter Rents at Bolton.—The Bolton Town Council, at their meeting on the 4th inst., confirmed the recommendation of the Gas Committee, alluded to in the Journal last week, for the abolition of gas-meter rents within the borough from the beginning of the next quarter. The meter-rents in the whole of the district supplied by the Corporation amount to £3200 per annum; and in the borough itself, to £2400. Alderman Miles, the Chairman of the Gas Committee, in explaining the matter to the Council, said the discontinuance of the rents would mean a difference of about £1200 for the present financial year; and he was happy to say that the undertaking was in a flourishing condition, so that the finances could well afford the sum mentioned. The effect the change would have upon the small consumers would be something like 2s. a year; the charge in these cases being now 6d. per quarter. Had they reduced the price of gas 2d. per 1000 cubic feet, as suggested, these consumers would have been relieved to the extent of 1s. 2d. per annum; so that the action of the Committee would be to the decided advantage of the ratepayers. Several members of the Council claimed to have brought about the abolition of the charge for meters; and as they rose one after another in the eager desire to "have a chalk," much amusement was caused. Alderman Miles said that the credit really belonged to the whole Committee, and not to any individual.

The Finances of the Burnley Gas Department.—At the last monthly meeting of the Burnley Town Council, Alderman Collinge, the Chairman of the Gas Committee, referred at some length to the loss which had resulted on the working of the Gas Department during the past financial year (noticed in the Journal last week), which had been brought prominently before the members in the report of the Finance Committee. He observed that the Borough Treasurer was quite right in estimating the loss to the department by the coal strike at £6100; and, in addition to this, they lost £2000 profit, which they ought to have made, through a diminished consumption of gas. It might be asked how it was that ouly a short time ago—in 1892—they were making between £6000 and £7000 profit with gas at 2s. 1d. per 1000 cubic feet, whereas now, with the price at 2s. 9d., they had a loss. The extra 8d. produced about £11,200, and made a difference between then and now of £17,800 altogether. Naturally the question would be asked: Why this loss? He would explain. Taking the estimate for 1895, their coal and cannel was put down to cost £8000. In 1892 they sold the tar produced for 30s. a ton; and now it was sold at 16s. Consequently, instead of having something like £3000 from this source, they would only have £1800. Their rates and taxes were raised to £1200; and since the readjustment their Town Hall expenses came to £450. This was not paid in 1892. The increased interest on account of the sinking fund was £1100; and adding to these amounts the estimated profit for the year (£5300), the total was brought up to £17,850. It should also be remembered that they had remitted meter-rents to the extent of £1800 per annum; and that wages had increased by £900. There was no discussion on the subject.

MISCELLANEOUS NEWS.

METROPOLIS GAS SUPPLY.

The Quality of the Gas in the Past Quarter.

The following is an abstract of the report of the Chief Gas Examiner for the Metropolis (Dr. A. W. Williamson, F.R.S.) as to the quality of the gas supplied by The Gaslight and Coke, Commercial, and South Metropolitan Companies, during the quarter ending the 30th ult.:—

I. *With respect to Illuminating Power.*—The average illuminating power, in standard sperm candles, at each of the testing-stations, was as follows:—

The Gaslight and Coke Company—	
Fenchurch Street, E.C.	16·4
Kinghorn Street, E.C.	16·6
Dorset Buildings, E.C.	16·7
Ladbroke Grove, W.	16·4
Devon's Road, E.	16·1
Carlyle Square, Chelsea, S.W.	16·1
Camden Street, N.W.	16·3
George Street, N.W.	16·2
Graham Road, E.	16·5
Kingsland Road, E.	16·4
Spring Gardens, S.W.	16·2
Grove Gardens, St. John's Wood, N.W.	16·1
Hornsey Road, N.	16·2
Lambeth Road, S.E.	16·2
Millbank Street, S.W.	16·5
Commercial Gas Company—	
Parnell Road, E.	16·2
Wellclose Square, E.	16·5
South Metropolitan Gas Company—	
Hill Street, S.E.	16·8
Bedford Road, S.W.	16·3
Stoney Lane, S.E.	16·4
Lewisham Road, S.E.	16·2
Blackfriars Road, S.E.	16·2
Burrage Road, S.E.	16·1

It will be seen, from these results, that the average illuminating power at all the testing-stations was higher than the parliamentary standard. The minimum was below the requirements at the Fenchurch Street, Carlyle Square, Kingsland Road, Spring Gardens, Grove Gardens, and Hornsey Road stations of The Gaslight and Coke Company, the Wellclose Square station of the Commercial Gas Company, and all the stations of the South Metropolitan Gas Company. At each of the other stations, the gas, even when weakest, was either equal to or above the requirements with respect to lighting power.

II. *As regards Purity.*—Sulphuretted hydrogen was not present in the gas. The average amount of sulphur in other forms than this was considerably less than the quantity allowed at all the stations. With the exception of the Fenchurch Street testing-place of The Gaslight and Coke Company and the Stoney Lane station of the South Metropolitan Gas Company, the maximum amount present in the gas at all the testing-places was within the limit allowed—viz., 17 grains per 100 cubic feet. Ammonia was generally present in the gas, more or less frequently throughout the quarter, but only in slight quantities. The limit allowed was not exceeded on any occasion.

THE PRICE, ENRICHMENT, AND TESTING OF LONDON GAS.

The South Metropolitan Company's Reply to Mr. Dibdin's Strictures.

Last week, pp. 95-9, we published extracts from three reports recently submitted to the London County Council by Mr. W. J. Dibdin, their Chemist and Superintending Gas Examiner; and to-day we are asked to give equal publicity to the reply sent to the Clerk of the Council on behalf of the South Metropolitan Gas Company. It is as follows:—

To the Clerk of the London County Council.

Sir,—Your letter of the 29th of June, and the accompanying reports by the Chemist of the Council—one on the subject of the price of gas, and the other on the existing gas-testing arrangements in London—have been very carefully considered by the Directors, who have to make the following (necessarily somewhat lengthy) reply.

Dealing first with the very serious charge made, or at least implied, in the report on gas-testing—that, in effect, this Company does not supply the public with gas of the quality required by Parliament, and that compared with the two other Metropolitan Gas Companies this Company's gas is very inadequately tested, the Directors would, in the first place, point out a very serious error in the report of your Chemist (on page 6), where he asserts that whereas The Gaslight and Coke Company has one testing-place to an average make of 3½ million feet, and the Commercial Company, one to 2¾ millions, this Company has only one to 6 millions. The mistake made by the Chemist consists in taking the *average* quantity of gas made in two cases, and the *maximum* in the case of the South Metropolitan, which is unaccountable, because he asked for "a statement of the amount of gas made at each of the works of your Company," and the reply was: "The make of gas at our various works is as follows." Then come the figures given in the report, and then the remark: "These figures represent the quantity of gas that has been made at different stations, but not the quantity we can make." The words, "the quantity that has been made," surely mean the maximum, while the word "average" is not mentioned in either letter.

Had the Chemist of the Council taken the trouble to check these figures by the quantities of gas sold by the three Companies—which are open to all the world, and are given by him in his other report, on page 3—by dividing the total quantities of gas sold by 365, he would have got the exact daily average, which for The Gaslight Company is 50 million feet; the South Metropolitan, 18 million feet; the

Commercial, 5·39 million feet. The ratio of gas sold to testing-stations is therefore—

	Stations.
The Gaslight and Coke Company . .	15 or 1 to 3½ millions.
South Metropolitan	6 or 1 to 3 ,,
Commercial	2 or 1 to 2¾ ,,

Undoubtedly, therefore, the gas of the three Companies is practically equally tested.

This mistake on the part of the Chemist is the more unaccountable, because on page 6 of his report on the price of gas it is clearly stated that The Gaslight Company's "annual sale of gas is equal to three times that of the South Metropolitan Company."

His argument that this Company's gas is inadequately tested consequently falls to the ground; and the Directors think that his more serious implied charge—that the Company does not comply with the requirements of Parliament—will be found to be equally baseless. In the first place, it is necessary again to state that photometry is not an exact science. It is quite possible for two men testing the same gas to obtain different results. Secondly, it must be pointed out that the 10-candle pentane Argand burner, used in the portable photometer, is rated at least a candle too high—that is, it makes 16-candle gas appear to be of only 15-candle power. It is true, candle tests are also made at the same time, and reported in parallel columns, which, during the last seven years, have amply proved the incorrectness of the 10-candle pentane Argand burner.

Up to about a year ago, this discrepancy between the burner and candles was—to the disparagement of the gas companies—assumed to be due to a supposed deterioration of the candles, and not to the incorrect adjustment of the burner; but last year the investigations of the Board of Trade "Standards of Light Committee" (of which the Council's Chemist is a member) showed that his 10-candle pentane Argand burner had been mistakenly rated or adjusted too high. It is, therefore, misleading to those who are not experts to continue to report tests made with this incorrect test-burner, as, notwithstanding the simultaneous report of tests made with candles which are discredited, the impression is conveyed that the Companies supply gas a candle worse than it really is. The Directors submit that, as soon as the incorrectness of the burner was proved, it should either have been readjusted, or its use discontinued.

Assuming, though it is certainly not clearly stated, as it ought to have been, that the tables of tests on pages 4 and 5 made by the portable photometer refer to actual candle tests, the Directors must again say that they cannot recognize them as fair or correct, especially when they represent this Company's gas to have averaged—as the result of only 70 tests—not more than 14·3 candles for the year 1893. The Directors do not question the honesty of the operator; but they are certain there was some reason connected with the portable photometer, and not the quality of the gas itself, for the low tests. Probably in those cases—numbering at least 45 out of the 70—there was naphthalene in the service-pipes, which frequently reduces the quality of the gas by from 1 to 2 candles. But this is a purely local defect, which it is impossible to prevent or to guard against, and should be removed before a test is made; or the gas may have been lying stagnant in the mains; or the meter may have been charged with fresh water, which appreciably reduces the illuminating power for the first two or three tests. Again, it is impossible to regulate the temperature of the room where the portable photometer is used, whereas in the official testing-stations, elaborate provision is made for this purpose, which is essential for correct testing; and this is probably one reason why the tests made by the portable photometer in the official testing-stations are more satisfactory.

Further, this return of an average of 14·3 candles for 1893 is conclusive proof of the unfairness and unreliability of the method of testing by the portable photometer. The returns by that instrument are set out on page 5; while the official tests are given on page 4 of the report. They are for the last four years as follows:—

	Official Tests, Average for the Year.	Portable Photometer, Average for the Year.
1890	16·3 candles	.. 15·4 candles
1891	16·4 ,,	.. 15·4 ,,
1892	16·3 ,,	.. 15·2 ,,
1893	16·4 ,, (nearly 2000 tests.)	.. 14·3 (70 tests.)"

The gas in 1893 was made in precisely the same manner, from the same descriptions of coal, and enriched in the same way, to the same extent as in the previous years; and that the quality was the same is *conclusively proved* by the official tests. It is, therefore, impossible that the returns of the portable photometer can be correct; and no man who understands the question would believe them for a moment. The Directors, therefore, submit that it is not fair to convey the impression, by publishing these returns, that this Company's gas was only equal to 14·3 candles last year.

Further, gas loses some of its light-giving properties, the farther it travels, by simple condensation, and from the effect of friction in the smaller mains. Very occasionally, under exceptional climatic conditions, there is no loss; but from various causes a certain amount is the rule, and has always and universally been recognized. Parliament, in acceptance of this fact, has never required any gas company—either in London or elsewhere—to have its gas tested at or on the consumers' premises. It has always been tested by a sample from the bulk; and the quality has been prescribed with the knowledge that it will lose something in distribution. Sometimes the Act of Parliament specifies that the gas shall be tested at the gas-works, and in other cases at a specified distance from the works, or at some central position (such as the Town Hall), necessarily on a large leading main, where a fair sample of the bulk can be obtained; but in no case on the small distributing mains. Practically it comes to this, and London may be taken to illustrate the point—

Gas at the works enriched to quite 17 candles.
Gas at testing-stations on large leading mains, rather over . . } 16 ,,
Gas on the consumers' premises, somewhat less.

If Parliament should adopt an entirely new system, and require the companies to supply 16-candle gas tested on the consumers' premises, the gas from Durham coal (practically the only available coal for London) would have to be enriched to quite 18 candles at the works, for which the consumers would have to pay a large sum for practically no benefit. It may here be noted that when gas is supplied of the quality obtainable from the coal without enrichment, there is comparatively little reduction of illuminating power in the course of distribution, as has been strikingly shown by the report of the Council's Chemist on the experiment made in April last by this Company of supplying gas without enrichment, whereby it was proved that the price of gas could be reduced without loss of light to the consumer, and consequently to his advantage.

In London, the gas was originally always tested at the works, which were, in the early days, always placed at or near the centre of the district supplied. Then, on the starting of the Great Central Gas Company by the late Mr. Croll in 1850, with works at Bow Common for the exclusive supply of the City, that gentleman provided for testing in the City—the district of supply. But it was only 12-candle gas. By The Gaslight and Coke Company's Act of 1868, and the South Metropolitan Act of 1869, it is provided that the testing-places shall be "as near as may be (but not less than) 1000 yards distant from the station from which the gas to be tested thereat is supplied." This section, however, was repealed in 1876; and the fixing of the testing-places was left to the Gas Referees, because some of the urban works had been abolished, and large manufacturing stations had been erected at Beckton and Bromley, and more recently at East Greenwich, outside London—like the Great Central already referred to—a long distance from the districts in which the gas was supplied. But it has always been understood that the gas should be tested by sample taken from a large main—generally the principal main leading from the works. This has been the practice of the Referees; and all this Company's gas is so tested. Therefore, before the gas can be legally and fairly tested anywhere on the consumers' premises, Parliament will have to make a distinct and special provision to that effect, which to be just must also authorize an increase in the price.

At present the Gas Companies are required by Parliament to supply gas which, tested by a prescribed burner, in a certain manner, by samples from the bulk at certain places, shall give a light equal to 16 candles; and the reports of the Council's testers prove conclusively that the Companies *more than fulfil their obligations*. If the gas were tested differently, a vastly different effect—either up or down—could be obtained from the same quantity and quality of gas that under the prescribed conditions gives a light equal to 16 candles. For instance, with many burners, not even the light of 10 candles can be got from the 5 feet per hour of 16-candle gas; whereas with others as much as 20 or 30 or more candles can be readily obtained. The light from a given quantity of gas is not a fixed and unalterable amount—like a pound of coal or a gallon of water—it varies to a considerable extent according to the method of testing and the conditions under which it is consumed. It can neither be weighed nor measured, but only compared with another light; and even the results obtained by different testers vary considerably, for in the Company's experience a change of testers frequently results in a considerable rise or fall in the reported quality of the gas.

The Chemist to the Council is in error when he says: "The gas supplied to the parishes of Rotherhithe and Deptford is not protected by a testing-station," because the Tooley Street gas-testing station is exclusively supplied from the largest main from the Rotherhithe works. The Directors, however, would raise no objection to the removal of that testing-station to another and more central part of the district supplied from those works.

The report on the price of gas does not directly affect this Company; but in reference to the general condemnation "of the policy of absorption" pursued by the Companies, it may be pointed out that the public authorities of a quarter of a century ago were strongly in favour of amalgamation, and that since 1876 the only amalgamations that have taken place have been the absorption of the London Company by The Gaslight and Coke Company in 1883, and the amalgamations of the Phœnix, the Surrey Consumers, and the Woolwich Companies with the South Metropolitan. And, without fear of contradiction, it can be said that all the amalgamations of the last-named Company have been to the benefit of the consumers; for in every case there was a considerable reduction in the price of gas in the district of the Company absorbed by the South Metropolitan.

In the concluding paragraph of his report on the price of gas, the Council's Chemist is not quite correct in stating that "an independent inquiry. . . was instituted by the Board of Trade in 1873," while its most important result is not stated. The Acts of 1868 and 1869 authorized the Companies, under certain circumstances, to make application to the Board of Trade to appoint Commissioners for the purpose of revising "the scale of illuminating power and price." In consequence of the great rise in the price of coal at that time, The Gaslight and the Imperial Companies did make such applications in 1873 and again in 1874. The result was an increase in the price charged for gas from 3s. 9d. to 5s. per 1000 feet. The Chairman of this Company (at that time its Engineer) was called upon to take part in both those inquiries as a witness; and this led him to suggest the abandonment of the old system, with its revision clauses—as being neither for the good of the Companies nor fair to the consumers—and the substitution of the sliding-scale, which in the following year was taken up by the Board of Trade and the Metropolitan Board of Works and embodied in legislation.

A word may be said on the subject of the Chemist's report on the question of a reduction of illuminating power. The experiments made by him simply prove the utter unsuitability of the burners for burning London gas, whether of 16, 15, or 14 candle power, and prove the necessity not of maintaining a needlessly high illuminating power at greater cost than the extra light is worth, but the substitution of economical for the wasteful burners now too much used. It is notorious that Paris is much better lighted with gas than London; and there the gas is only of about 13, or at the most 14 candle power. Yet by the proper use of suitable burners, a far superior effect is obtained. It would have been an easy matter for the Chemist to have found burners that would have given still worse results; and it would

have been equally easy to have found others that would have given very much better results.

Seeing that these reports by the Council's Chemist have been published in the JOURNAL OF GAS LIGHTING, a copy of this reply will also be sent to that paper.

(Signed) FRANK BUSH, Secretary,
July 14, 1894. South Metropolitan Gas Company.

MANCHESTER CORPORATION GAS-WORKS.

Abstract of the Annual Accounts.

In the JOURNAL for the 3rd inst., we gave the main portions of the reports of the Gas and Electric Light Departments of the Manchester Corporation for the year ended March 31 last. The following are some of the principal figures in the accounts of the gas undertaking for this period, which accompanied that report, and are signed by the Superintendent (Mr. Charles Nickson).

PROFIT AND LOSS ACCOUNT.

EXPENDITURE.

Cannel and coal (including cost of unloading, &c.)		£293,280	10 0
Retort men's wages		48,179	5 5
Retorts, fire-bricks, &c. (including cost of setting)		12,837	12 0
Repairs and maintenance of works, mains, &c.		50,373	19 0
Purifying material and wages		5,428	7 5
Salaries and wages of clerks in Superintendent's office, rental and inquiry offices, and meter inspectors		16,605	5 4
Collectors' salaries		7,229	12 4
Rents, rates, and taxes		23,148	6 10
Renewals of plant, &c.		21,634	17 11
Bad debts		570	10 0
Miscellaneous expenses		3,962	19 8
Lighting, repairing, and maintaining city lamps		13,004	11 3
		£496,255	17 2
Balance carried forward		72,775	17 3
		£569,031	14 5
Interest		£28,232	5 1
Sinking fund		13,954	0 0
Balance carried down		30,589	12 2
		£72,775	17 3

INCOME.

Gas-rental		£400,707	1 2
Meter-rents		12,825	5 7
Stove-hire		1,288	6 0
Total cost of street lighting paid out of city fund—			
Value of gas	£31,873 1 8		
Lighting, repair, and maintenance	13,004 11 3		
		44,877	12 11
Public lamps beyond the city		4,801	6 9
Residual products—			
Coke	£53,211 3 3		
Tar	18,270 5 10		
Ammonia water	32,774 3 5		
		104,255	12 6
Rents of cottages, &c.		276	9 6
		£569,031	14 5
Balance of profit		£30,589	12 2
Transferred from contingent fund account		33,731	7 10
		£64,321	0 0
Amount paid over to the city fund account		£64,321	0 0

STATEMENT OF ASSETS AND LIABILITIES.

ASSETS.

Gaythorn station—land, buildings, and apparatus	£231,715	1 6
Rochdale Road station	274,296	7 2
Bradford Road station	473,911	0 6
Droylsden station	24,919	11 5
Street-mains stores (Poland Street)—land, buildings, and apparatus	2,961	8 10
Street-mains	388,811	3 11
Service-pipes	63,460	2 6
Hired meters	85,162	0 7
Hired stoves	10,648	8 11
Stoves show-rooms	100	0 0
Cottage property purchase-money	1,652	13 6
Total property	£1,557,637	18 10
Cannel, coal, retorts, and other material in stock	89,623	13 1
City fund, for street lighting, less £44,048 11s. 2d. received on account	829	1 9
Gas-rents and other accounts due to the Committee	154,348	2 8
Cash in hand	5,039	7 4
Total property and assets	£1,807,478	3 8

LIABILITIES.

Mortgage debt	£653,976	0 0
Sums advanced (not secured by mortgage)	1,430	0 0
Temporary loan from Manchester Ship Canal Company	175,000	0 0
Accounts owing for coal, &c.	47,137	13 7
Deposits held in security of gas-rents	37,670	13 4
Interest due thereon	5,024	7 9
Cash deposits for due performance of contracts	5,050	0 0
Amount payable on account of cottage property	1,600	0 0
Amount owing to bankers	2,460	3 9
Total liabilities	£929,348	18 5
Total liabilities brought forward	£929,348	18 5
Surplus and sinking fund, as per last statement	£858,294 10 0	
Transferred from profit and loss account for the year ended March 31, 1894	13,954 0 0	
	872,248	10 0
Contingent fund account—		
Amount as on March 31, 1893	£39,612 3 1	
Less transferred to the profit and loss account to meet deficiency this year	33,731 7 10	
	5,880	15 3
	£1,807,478	3 8

GENERAL SUMMARY OF THE CAPITAL AND REVENUE ACCOUNTS.

RECEIPTS.

Balance brought forward (see summary March 31, 1893)	£88,697	2 8
Amount received on sale of clay, &c., at Bradford Road	50	0 0
Loans received during the year	12,665	0 0
Temporary loan from Manchester Ship Canal Company	175,000	0 0
Sinking fund, transferred from profit and loss account	13,954	0 2
Balance of profit and loss account (as per statement)	30,589	12 0
	£320,955	14 10

EXPENDITURE.

Loans repaid		£26,941	0 0
Amount paid over to the city fund account, being the estimated year's profits		64,321	0 0
Expenditure charged to capital account		78,796	8 5
Stocks on hand	£89,623 13 1		
Gas-rents, &c., due	155,177 4 5		
Cash in hand	5,039 7 4		
	£249,840 4 10		
Less accounts owing to sundry creditors	98,942 18 5		
		150,897	6 5
		£320,955	14 10

The accounts proper are followed by the usual appendices, giving some interesting statistics as to the progress of the gas undertaking during the past municipal year.

The figures in Appendix A—a statement of the lamp and private rental, including meter and stove rents, derived from within and beyond the city—have already been given when dealing with the profit and loss account.

Appendix B is a comparative statement of the gas transmitted from the works in the daytime and during the twenty-four hours, for the past two years. Summarized, the figures are as follows:—

	Daytime. Cubic Feet.		Twenty-four Hours. Cubic Feet.
Year ended March 31, 1893	940,454,000	..	3,634,690,000
Do. do. 1894	865,994,000	..	3,532,035,000
Decrease	74,460,000	..	102,655,000

	Cubic Feet.
Quantity of gas transmitted from works	3,532,035,000
,, measured and accounted for	3,419,125,000
Loss (by condensation and leakage)	112,910,000, or 3·2 per cent.

In Appendix C, particulars are given as to the results of the working from June 24, 1880, to March 31, 1894. The table contains statistics as to the number of tons of coal carbonized, the total make of gas, the yield per ton of coal, the illuminating power of the gas, the quantity of residual products, &c., for each year in the above-mentioned period. The particulars for the past financial year are as follows: Coal and cannel carbonized, 360,654 tons; gas made, 3,535,208,000 cubic feet; yield per ton of coal carbonized, 9802 cubic feet; illuminating power, 19·04 candles; make, reduced to 20-candle power, 3,365,518,000 cubic feet; make per ton, 20-candle power, 9332 cubic feet; make of coke, 235,474 tons; do. per ton of coal, 13·06 cwt.; make of tar, 21,990 tons; do. per ton of coal, 11·90 gallons; make of ammoniacal liquor, 9,601,065 gallons; do. per ton of coal, 26·62 gallons; make at 10-oz. strength, 9,142,616 gallons; do. per ton of coal, 25·35 gallons.

Appendix D shows the number of stoves and of each size of meter in use during the year in the city and out-townships. At the close of the past financial year, there were 4700 stoves in use within, and 1460 beyond the city—together, 6160. Of these, 2343 were on hire within, and 776 beyond the city (together, 3119), as compared with 2005 and 647 (together 2652) at the corresponding date in 1893; so that there was an increase of 467. The numbers of the meters in use were 81,637 in 1894 and 81,433 in 1893. There was last year a net increase of 204 on the number for the preceding year. Of the total number at work on March 31 last, 71,796 were on hire, as compared with 71,148 at the close of the financial year 1892-3. The number of prepayment meters on hire on March 31 last was 525—an increase of 316 on the number at the close of the preceding year.

From Appendix E we learn that the gas-mains laid last year within the city amounted to 22,215 yards, and beyond the city to 10,589 yards—a total of 32,804 yards, or 18 miles 1124 yards. The mains taken up were 11,157 and 4453 yards respectively—a total of 15,610 yards, or 8 miles 1530 yards. The total net increase during the year therefore was 17,194 yards, or 9 miles 1354 yards. The total length of mains laid at March 31 last was 1,257,518 yards, or about 714½ miles.

Appendix F consists of a statement showing the amount of gross profit made from the gas undertaking, and the mode of its appropriation, also the amount of borrowed money owing, excess of assets, &c., from 1862 to March last. The figures for the past financial year are as follows: Profit, £72,775; paid over for improvement purposes, £64,321; transferred from contingent fund, £33,731; borrowed money owing, £830,406; and excess of assets, £878,129. The profit of £72,775 is appropriated thus: Interest, £28,232; liquidation of mortgage debt, £13,954—leaving a surplus of £30,589.

THE SALFORD CORPORATION GAS AND ELECTRIC LIGHT DEPARTMENTS.

Annual Report of the Gas Committee.

The Gas Committee of the Salford Corporation have issued their annual report, which is accompanied by the accounts of the gas and electric light departments for the year ending March 25 last. The quantity of gas made was 1,090,952,000 cubic feet, of which 1,008,733,000 cubic feet were sold and used, and 81,528,000 cubic feet not accounted for, or 7·47 per cent. on the make. As compared with the preceding year, there was a decrease of 20,844,000 cubic feet, or 1·87 per cent. in the quantity of gas made; of 9,835,000 cubic feet, or 0·97 per cent. in the quantity sold and used; and of 10,203,000 cubic feet, or 11·12 per cent., in the gas unaccounted for. The percentage of loss to the make in 1892-3 was 8·25; being 0·78 per cent. more than last year. The average illuminating power of the gas was 18·70 candles—the standard being 18 candles. The rental from private consumers of gas within and beyond the borough last year amounted to £103,543; from public lamps, to £14,535; from meters, to £1970; and from stoves, to £296—making a total of £120,344, as compared with £123,675 in 1892-3, and being a decrease of £3331. The total decrease would have been greater, but for an increase of £146 in the receipts beyond the borough. The number of consumers last year was 28,305; and of public lamps, 7566—increases of 300 and 197 respectively, as compared with the preceding twelve months. During the year, the Committee laid an additional 4312 yards of new mains, and replaced 8641 yards by others of larger dimensions. The total length of mains at the close of the year was 387,811 yards. The quantity of coal and cannel carbonized was: Coal, 76,074 tons; cannel, 32,902 tons—together, 108,976 tons. The proportion of cannel was 30·19 per cent. The average yield of gas per ton of raw material was 10,011 cubic feet. The gas used on the works and in the offices, &c., amounts to 10,843,000 cubic feet; being 0·99 per cent. of the make. The gross profit realized was £41,519, of which £36,239 goes for interest, sinking fund, &c.; leaving a net profit of £5280 payable to the district fund.

At the outset of their report to the Council, the Committee refer to the increased outlay entailed by the coal strike, which amounts to £14,762, reduced to a net sum of £9762 by the extra value of the coke sold. The yield of gas fell off by about 400 cubic feet per ton, owing to the lower quality of the coal which had to be used. The Committee succeeded, however, in maintaining an ample and uninterrupted supply of gas, of the customary standard, throughout the whole period of the dispute. Though they had these difficulties to contend with, and had, earlier in the year, discontinued the charge for the hire of meters, which reduced the revenue by £1863, they were averse to increasing the price of gas. Their policy was ably carried out by the Gas Engineer (Mr. S. Y. Shoubridge) and his staff; and they record with satisfaction, at the close of the financial year, the small diminution of only 1 per cent. in the sale of gas, which was much less than they anticipated. They have been able to meet all the extra expenditure incurred, and hand over to the district fund, in reduction of the rates, £1280 more than the estimated amount. There was a reduction of £1679 in carbonizing wages, and of £362 in purifying wages last year, though 2777 tons more coal and cannel were used. The cost of repairs to works and plant was £950 less than in 1892-3; the expenditure on public lamps and fixing gas-stoves, £137 less; and law charges and bad debts, £1011 less. The expenditure on meters, mains, and services was £325 more; on rents, rates, and taxes, £569 more; and on management, £199 more. The total expenditure on revenue account was £114,132, or £4858 more than in the preceding year. On the credit side, the sale of gas yielded £1563 less, owing to the coal strike, and the exceptionally fine weather. There was an increase of £95 in the stove-rental, and a very gratifying improvement in the receipts for residuals. Coke produced £6657 more; tar, £467 more; and sulphate of ammonia, £4390 more. The total income from all sources was £155,651, or £8183 in excess of the previous year. With regard to the works, the enlargement of the principal gasholder at the Regent Road station was satisfactorily completed last autumn. The new retort-house, coal-store, and railway-sidings are almost finished; and a bench of inclined retorts has been built and equipped with the necessary coal-breaking and elevating machinery. This will shortly be set to work. The enlargement of the trunk main to Eccles was completed last autumn; and the supply to the out-districts in the winter was thereby greatly facilitated. In order to still further increase the supply to these districts, the leading main from Eccles to Patricroft is to be taken up this summer, and a much larger one substituted. The sale and hire of gas cooking-ranges and fires continue satisfactory. During the past year 269 ranges were supplied on the simple hire system, 63 on the hire-purchase system, and 23 were sold; 192 gas-fires were also sold.

With respect to the electric lighting undertaking, the Corporation have raised on loan £32,000. Of this sum they have spent on land £2972; on the generating and distributing station, £71, on mains and services, £54; and on preliminary matters, £376—leaving a balance of £28,527 unexpended.

STOCKPORT CORPORATION GAS SUPPLY.

The Extension of the Gas-Works—Annual Financial Statement.

In moving the confirmation of the minutes of the Gas Committee at the last meeting of the Stockport Town Council, the Chairman (Mr. T. Webb) referred to the financial results of the gas-works for the year ending March 31, and also to the large scheme of extension at the Portwood works, which was commenced in 1890, and has now been completed. There were still, he said, a number of important works required—such as new store-rooms, railway communication, sulphate-house, and so forth; but so far as the gas-making plant was concerned, the works were now completed, and would probably be sufficient for the next ten years. The buildings had cost £8639; gasholder and tank, £19,459; machinery, £3084; retort-fittings, £3365; and smaller items, £3556—making a total of £38,905. The additional plant which his expenditure had placed at the disposal of the Council represented an increased manufacturing capacity at the works of 700,000 cubic feet of gas per day on the present output—making the maximum producing capacity at the Portwood, Heaton Lane, and Millgate works 3,500,000 cubic feet per day. When it became necessary to further enlarge the plant, the storeage accommodation would have to be extended. He need scarcely tell the Council that last year was one of very great anxiety to the Committee and the Engineer (Mr. S. Meunier), owing to the prolonged strike of colliers. At the commencement of the year, the coal trade was in an unsettled state; and the Engineer was authorized to get in a good stock of coal. They had, at the beginning of the year, about 5000 tons in hand; but the Committee were forced to purchase before the end of the dispute. The average cost of cannel during the strike was 27s. 6d. per ton; whereas the average on the contract was 15s. 10½d. The cost of coal bought during the strike averaged 18s. 9¾d.; and the average on contract was 10s. 1d. The total extra expense to the Council during the lock-out was £3465. To counteract this additional expenditure, they had an increased revenue of £1109 on gas, £1810 on coke, £1017 on ammoniacal liquor, £108 on meter-rents, and £27 on stove-rents; making a total of £4067. There was a loss on tar of £231—leaving a net increase of £3636; but the increased revenue above the expenditure amounted to £370. He thought that the Council, with the Committee, would feel that they had passed through a very trying year in a fairly satisfactory manner. He moved the adoption of the Committee's minutes. Mr. Lister having seconded the motion, Mr. Hidderley said he assumed that the gas-works were now worth £300,000; and it would not be an unreasonable thing, he thought, for the ratepayers to expect 4 per cent. interest on that amount. As soon as the profits reached £12,000, and not before, he would advocate a reduction in price. The motion was adopted.

THE BRADFORD CORPORATION AND THE RIVAL OIL-GAS PROCESSES.

At the Meeting of the Bradford Town Council last Tuesday, the presentation of the minutes of the Gas and Electricity Committee gave rise to a discussion on the question of the oil-gas experiments, to which reference has previously been made in our news columns. The minutes included a resolution accepting the offer of Messrs. R. and J. Dempster, Limited, to provide and fix apparatus and fittings at the Valley Road Gas-Works for the manufacture of oil gas by the Peebles process, at an estimated cost of £1218, upon which the Corporation are to pay interest at the rate of 7½ per cent. per annum, until they shall determine whether or not to take over the plant. The adoption of the minutes having been formally moved and seconded, Mr. W. C. Dixon proposed, as an amendment, that the resolution should be extended, so as to embrace the offer of the Northern Counties Hydro-Oxygen Gas Company, Limited, to conduct an experiment. Mr. Dixon said he did not believe the comparative merits of the two systems had been thoroughly thrashed out. He was not at all biassed in favour of the adoption of either system; but what he desired was that the process which turned out to be the best should be adopted. The Manager of the St. Helens Gas-Works stated that he could produce 22,000 cubic feet of 50-candle power gas per ton of oil; and at Huddersfield, the Manager said he could produce 27,433 cubic feet of 76-candle power gas. This showed a difference in favour of the oxy-oil process of above 90 per cent. in actual candle power. Mr. Dixon went on to contend that the report of the Corporation Engineer on the subject contained calculations made on a wrong basis, and that, in enriching value, there was a difference of 33 per cent. in favour of the Huddersfield system. The Northern Counties Company were first in the field to make the Corporation an offer. They suggested putting down plant valued at about £4000; and they were ready to reduce the term from five to three years. The amendment was seconded by Mr. Walker. Alderman Morley said that, if the Huddersfield system were adopted, plant would be laid down costing at least £4000. If the result was an improvement, the profit was to be equally divided between the Corporation and those who made the experiment. If the system were adopted, a royalty would have to be paid which would come to £3000 or £4000 a year; and the consequence was that very little benefit would accrue. Plant on the St. Helens system would be put down costing £1218; but the royalty would only be one-third of that in the other case, and better results were guaranteed. Alderman F. Priestman was of opinion that the Council could not decide on the merits of the two systems, when the Gas Committee were not unanimous. He thought the Committee had sufficient to do at present in looking after the system now being tried at the Thornton Road works; and he urged that the minute over which discussion had arisen should be referred back, on the understanding that it should remain in abeyance till the merits of the process now under trial had been ascertained. Alderman Moulson, the Chairman of the Committee, said it was not his wish to enter upon any other process until the Committee had finished their present trial; but the matter had been pressed forward till it could not be resisted. He was quite willing, if it could be held over, to withdraw the resolution under discussion from the minutes. On this understanding, Mr. Dixon withdrew his amendment. Mr. Cowgill then proposed, and Mr. J. Hayhurst seconded, an amendment that the minutes should be adopted in their entirety, without the withdrawal agreed to by Alderman Moulson. Alderman Morley supported this amendment; remarking that, if the outlay of £1218 did not effect what had been promised, the contractors would remove the plant and not charge the Corporation a penny. The Corporation would now have to get tenders for coal; and they would not require cannel coal if this system were carried out. As there was really no cost to the Corporation, he supported the amendment. The discussion was continued for some time longer, during which Mr. Dixon expressed his intention of allowing his amendment to stand; and Alderman Moulson readopted the original form of his motion approving the minutes in their entirety. In the end, Mr. Dixon's amendment was defeated; but another, proposed by Alderman Priestman, referring the resolution back to the Committee for further consideration, was carried by 22 votes to 17.

THE PLYMOUTH GAS COMPANY'S BILL.

In the JOURNAL for the 3rd inst., we recorded the withdrawal of the opposition of the Plymouth Corporation to the Gas Company's Bill in the House of Lords. The measure accordingly came before the Earl of Morley's Committee on Unopposed Bills, when a few interesting matters were discussed. It was explained by Mr. Cripps, of Messrs. Dyson and Co. (the Parliamentary Agents for the promoters), that there was a little difficulty with regard to the figures in the consolidation clause. He thought, however, that they were right as they appeared in the Blll. The total was £206,850. The amount of dividend to the shareholders was thoroughly discussed in the other House, and appeared in the Bill. He asked Mr. J. Shelly, the Solicitor for the Bill, to explain. Mr. Shelly said there were three classes of stock —the 10, the 7½, and the 7 per cent. By the operation of the clause, the 10 per cent. stock would get 12½ per cent.; the 7½ per cent., 9¾ per cent.; and the 7 per cent., 9¼ per cent.—2¼ per cent. being added to the dividend by the sliding-scale. They were proposing to change the shares into stock, and they intended issuing £50,000 of stock in exchange for the £25,000 original 10 per cent. shares; £111,475 for the £70,000 of 7½ per cent. shares; and £45,375 for the original £30,000 of 7 per cent. shares. By converting these shares into stock, 6¼ per cent. on the sliding-scale would be precisely equivalent to 12½ per cent. on half the amount; and by giving the shareholders £50,000 of stock, they gave them precisely the same dividend. Then they took the 7½ per cent. shares at 9¾ per cent., and in order to arrive at the exact equivalent of £70,000, they had £111,428 11s. 6d. and a fraction; and the £30,000 of 7 per cent. stock at 9¼ per cent. worked out to £42,375. The Chairman's Counsel (Sir J. Warner) remarked that he questioned the expediency of the proposed arrangement, which, no doubt, was good for the shareholders. Mr. Cripps said they had been advised that this was the proper way of doing it. The difficulty under the operation of the sliding-scale arose in this way: The rate of dividend on the 7½ per cent. stock was increased more in proportion than on the 10 per cent. stock. Mr. Shelly said the precise figures were these: The 10 per cent. shares would get £20; the 7½ per cent., £15 18s. 6d.; and the 7 per cent., £15 2s. 6d. A long discussion took place as to the advantages to be gained by consolidating the stock. Mr. Shelly pointed out the great economy in book-keeping that would ensue from the alteration, and likewise the advantage in the sale of stock. He said people did not now understand what they were buying. A long discussion also took place in regard to clause 19, which provides that, if the clear profits of the undertaking of the Company in any year amount to a larger sum than is sufficient to pay the dividend at the authorized rate on the ordinary capital of the Company, the excess, or such portion of it as is not carried to the insurance fund, shall be carried to the credit of the divisible profits of the undertaking for the next following year; it being provided that the Company shall not in any half year carry forward a larger balance than £10,000. Sir J. Warner desired to know what would be done with the money if the balance became larger than £10,000. Mr. Cripps said the balance would be treated as something to be taken into account for the reduction of the price of gas. The Earl of Morley remarked that he did not see the object of this provision, in the interest of the public. When the Company's profits were so large, they must reduce the price. The Company's Secretary (Mr. J. Thomas) said they would have to reduce the price at once. His Lordship thought the Bill must go without that proviso. Mr. Cripps asked his Lordship to pass the preamble of the Bill, and keep back the report in order to give him an opportunity of conferring with Mr. G. Livesey on the subject. This course was agreed to.

BOLTON CORPORATION WATER SUPPLY.

Annual Inspection of the Water-Works.

The Water Committee of the Bolton Corporation made their annual inspection of the several reservoirs and principal sources of supply at Heaton, Belmont, and Entwistle, on the 5th inst.—a representative of the JOURNAL being present by invitation of the Chairman of the Committee (Alderman Cannon, J.P.). The party, which included members of the Council, was accompanied by Mr. R. H. Swindlehurst, M.Inst.C.E., the Water Engineer, who conducted the visitors, and gave some very interesting particulars of the undertaking. The population of the water district of the Corporation is estimated at upwards of 240,000; and the area of the limits is 56,620 acres. There are in all eight reservoirs of water suitable for domestic purposes, estimated to contain 1153⅓ million gallons; and the compensation reservoirs, which number three, hold 1113 million gallons—making a grand total storeage of 2266⅓ millions. The cost, with the filter-beds, &c., is set down at £766,471 up to date; this sum including £112,500 expended many years ago in buying out the shareholders of the old Water Company, who were receiving an annual rent of £4500. The largest reservoir is the one at Entwistle, which holds 625 million gallons. It receives the drainage from 2118 acres, and is 600 feet above the level of the sea. The other reservoirs are as follows: Springs, 134 millions; Dingle, 79 millions; Sweetloves, (two) 95 millions; Heaton, 91 millions; High Rid, 130 millions; Crowthorn, 3½ millions; Belmont, 468 millions; Rumworth, 95 millions; and Wayoh, 550 millions. The supply is by gravitation; and the collecting-ground or drainage area of the reservoirs is chiefly moor-land or high mountain pasture of the millstone grit formation. The water is filtered at Sweetloves and Heaton through a filtering area of 13,658 square yards, and is delivered into the town pure at high pressure, with a constant supply. The party were conveyed to the several points in waggonettes; and the drive altogether extended over 24 miles. The weather was all that could be desired for the purpose; and the party spent a pleasant and profitable day. The water-works are undoubtedly a credit to the town; but, from a hint dropped by the Chairman of the Committee in an after-dinner speech, it seems that before long the Corporation will be asked to sanction the construction of another reservoir. The Committee are now spending £20,000 in improving the drainage area and in altering the filter-beds.

WATER PROVISIONAL ORDERS FOR THE PRESENT SESSION.

The Board of Trade have issued a Memorandum stating the nature of the proposals contained in the Provisional Orders included in the Water Orders Confirmation Bill now before Parliament. It comprises Orders relating to Bishop's Waltham, Blandford, East Surrey, Tilehurst and District, and West Cheshire.

The Bishop's Waltham Order is to empower the Bishop's Waltham Water-Works Company, Limited, to maintain and continue waterworks, and to supply water in the parish of Bishop's Waltham. The capital of the undertaking is fixed at £10,000 by shares, with borrowing powers not exceeding one-fourth of the share capital actually raised. The Blandford Order is to authorize the Blandford Water-Works Company, Limited, to construct and maintain waterworks, and to supply water in the parishes of Blandford Forum, Bryanston, Blandford St. Mary, Langton-Long Blandford, Pimperne, Charlton Marshall, and Spetisbury; and it contains provisions with reference to the purchase of the undertaking by the Corporation of Blandford Forum. The capital is fixed at £10,000 by shares, with borrowing powers to the extent of £2000. The East Surrey Order is to give the East Surrey Water Company power to purchase additional lands by agreement, as well as to raise further capital, not exceeding £80,000 by shares, with borrowing powers equal to one-fourth of the share capital issued. The Tilehurst and District Order is to empower the Tilehurst, Pangbourne, and District Water Company, Limited, to construct and maintain water-works, and to supply water in the parishes of Sulham and Purley, and parts of the parishes of Tilehurst, Pangbourne, Tidmarsh, Whitchurch, and Englefield. The capital of the undertaking is fixed at £16,000 by shares, with borrowing powers to the extent of one-fourth of the share capital issued. The West Cheshire Order extends the limits of supply of the West Cheshire Water Company, so as to include the townships of Shotwick, Capenhurst, Great Saughall, Little Saughall, and Woodbank, in the parish of Shotwick; the townships of Stoke, Great Stanney, and Little Stanney, in the parish of Stoke; the portion of the township of Whitby situate in the parish of Stoke; and the township or parish of Stanlow. It also empowers the Company to enter into agreements with the Corporation of Liverpool for a supply of water in bulk.

Stratford-on-Avon Gas Department.—In presenting the report of the Gas Committee at last Tuesday's meeting of the Stratford-on-Avon Town Council, Mr. Hawkes announced that the result of the year's working was that £657 would be carried forward as profit, compared with £621 last year; while £450 would be devoted to the relief of the rates, as against £400.

A New Gasholder for the Torquay Gas Company.—The Torquay Gas Company are erecting a large new telescopic gasholder (arranged for a third lift), with latticed standards and girders, and constructed throughout of Bessemer steel. The designs for the work were prepared by the Company's Engineer (Mr. R. Beynon); and the capacity will be about 500,000 cubic feet. The contract has been obtained by Messrs. Willey and Co., of Exeter.

The Opposition to the Chesterfield Gas and Water Bill.—The Parliamentary Committee of the Derbyshire County Council have reported that the cost of the opposition of the county to the Bill of the Chesterfield Water and Gas Company has been somewhat heavy. The accounts have not yet been taxed; but they will probably amount to about £600, of which nearly £400 was expended in Counsel's fees. The Committee express the hope that the Council will be satisfied that this expenditure has been amply justified by the result.

The Payment for Water Supplied to Wakefield Out-Districts.—In last week's issue, it was reported that the Castleford Local Board had decided to contest the claim of the Wakefield Corporation for £281 for water supplied, owing to the water being unfit for consumption. We now learn that the Normanton Local Board have, on the same ground, determined to defend an action commenced against them by the Corporation for the recovery of £169 11s. 1d. for water supplied to Dec. 30 last; and with respect to the demand of the Corporation for £726 18s. for water supplied between then and June 30, they have resolved that £700 shall be paid, without prejudice to the Board's claim for damages on account of the unwholesome condition of the water.

A Question as to the Recovery of Water-Rates.—In the Lord Mayor's Court last Thursday, before the Recorder (Sir Charles Hall, Q.C., M.P.), a question as to the recovery of water-rates was raised in the case of *The East London Water-Works Company v. Kyffin*. The plaintiffs sued the defendant, who resides at Springfield Road, Upper Clapton, and is a vestryman, for £45 14s., for water supplied or "to be supplied" to some 30 houses in the neighbourhood of Hackney, of which he is the owner. Mr. L. Glyn and Mr. G. Kebbell appeared for the plaintiffs; Mr. Walter represented the defendant. Mr. Kyffin, it was stated, was defending the action in the public interest. The principal defence set up was that the Company were barred from recovering in that Court by Jarvis's Act, which enacts that a water company shall proceed before Justices for the recovery of water-rates within six months of their coming due. Another contention was that the plaintiffs were not entitled, under their Acts, to claim payment of rates in advance from owners as opposed to occupiers. After much argument, the Recorder ruled that, under section 74 of the Water-Works Clauses Act, 1847, the plaintiffs were entitled to sue in this Court, and were not limited or barred by Jarvis's Act; and, further, that the Company had the right to claim payment of rates in advance from owners. He accordingly gave judgment for the plaintiffs for £42 10s. 6d., the amount sued for less £3 3s. 6d. which had been claimed in respect of water supplied to empty houses. He also certified for costs on the higher scale, on the ground that the case was one of public importance.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

The new gas-works at Dunfermline were coupled up with the mains on Tuesday of this week; and they will now be gradually brought into use. The retorts have been fixed upon the regenerative system invented by Mr. G. R. Hislop, of Paisley.

This week there are quite a number of annual statements of accounts for the past year. At Peterhead, it was reported to the Police Commissioners on Monday that the revenue from the gas undertaking had been £4700, which was £53 in excess of the sum received in the preceding year; and that the expenditure was £2913, or £545 less than the year before. There was thus a balance of £1786, which compared favourably with the £1188 in the preceding year. There was a net profit of £596, at which Provost Smith, in presenting the accounts, was gratified; and he characterized it as the most favourable statement it had ever been his fortune to lay before them. He paid a well-deserved tribute to the care and attention which the Manager had bestowed upon his work. The price of gas was reduced from 5s. 10d. to 5s. 6d. per 1000 cubic feet.

Mr. R. S. Carlow, of Arbroath, has finished a year which is quite satisfactory in regard to all that a Manager can do. During this period there was carbonized 4628 tons of coal, which was a decrease in quantity of 196 tons upon the preceding year; but the yield of gas, which amounted to 10,004 cubic feet per ton of coal, was 250 cubic feet per ton more than was derived in the preceding year. The total quantity of gas made was 46,306,100 cubic feet, or a decrease of 725,600 cubic feet, which, considering the state of trade in the town, was remarkably small. The unaccounted-for gas rose from 7·454 to 8·792 per cent. There was a revenue of £9573, of which £8632 was from gas; and the working was so nicely balanced that the net profit was only £4 10s. 8d. The accounts for the year had to bear a debit of £147 in regard to the failure, two years ago, of Messrs. Dobbie, the tar contractors. The revenue from gas was £1181 less than in the previous year, which was accounted for by the reduction in the price from 4s. 7d. to 4s. 2d. per 1000 cubic feet. The Commissioners retained the price at the latter figure.

At Greenock, it was reported to the Committee of the Gas Trust this week, that the total revenue of the Trust for the year ending June 30 was £38,862, as against a total expenditure of £37,460, giving a balance to the credit of the Trust for Police Board purposes of £1402. This shows a very considerable improvement on last year's surplus of £57. The estimated revenue from gas supplied by meter for 1894 was £26,750; and the amount received was £25,945. The estimate of £2400 from contract consumers was exceeded by £58; that from residual products was expected to yield £5400, and produced £6077; town and harbour lamps' estimated income was £4250, and yielded £4286. The expenditure was as follows: Cannel coal, £13,556; interest, £4485; sinking fund, £4000; wages and salaries, £6609; repair to retort-bench, £461; feu-duties, taxes, insurances, &c., £2240; town and harbour lamps, £2173; working residual products, £1341. Other smaller sums, added to an extraordinary expenditure of about £1100, make up the total outlay to £37,460. It is to be remembered that this satisfactory financial state has been accomplished with the rate lowered by 1½d. per 1000 feet at the beginning of the financial year.

The Dumfries Gas Commission had their annual accounts before them on Monday. Mr. Malam, in his report, stated that during the year there was carbonized 5964 tons of coal and 100 tons of oil, at an average cost of 16s. 10¾d. per ton, as compared with 6026 tons of coal in the previous year, at an average cost of 17s. 7d. per ton. There was produced 62,158,800 cubic feet of gas, which was at the rate of 10,248 cubic feet per ton, as against 9767 feet per ton. Unaccounted-for gas amounted to 10·95 per cent. The Peebles oil-gas plant was started on Feb. 19 last, and had worked with entire satisfaction. For the current year, there would be a saving of £464 by the use of oil. The Commission is not in the best financial position, having their capital account overdrawn to the amount of £3097, upon which they are paying 5 per cent. interest. They are also under the necessity of expending £4000 upon new purifiers, which will add to their burdens. On account of their financial position, it was found impossible to reduce the price of gas, though a number of the members favoured a proposal to that effect; and it was retained at 3s. 6d. per 1000 cubic feet. The accounts showed a very satisfactory balance of profit—to £2313, which compared favourably with £35 last year.

The Stirling Gas Company have resolved to reduce the price of gas from 3s. 7d. to 3s. 4d. per 1000 cubic feet, which is the lowest price ever charged for gas in the town. In 1843, the price was 10s. per 1000 cubic feet.

The Alloa Gas Commissioners had a revenue last year of £7094, of which £6174 was derived from the sale of gas, £369 from tar, and £468 from coke and refuse lime. There was a balance on the year's accounts of £842. Provost Thomson, in presenting the accounts, said the oil-gas process had come quite up to their expectation; and by its use they were able to reduce the price of gas from 3s. 4d. to 3s. per 1000 cubic feet. Mr. Yuill will give a full account of the working of the process in his paper to be read at Glasgow on the 26th inst.

The Penicuik Gas Company, who also use the Peebles oil-gas process, have paid dividends at the rate of 5 per cent. on the preference, and 7 per cent. on the ordinary shares. The illuminating power of the gas supplied by the Company is over 30 candles.

The annual meeting of the Saltcoats Gas Company was held on Wednesday—Dr. Brown presiding. An abstract of the revenue and expenditure for the past year showed that the Company is in a very favourable position. The ordinary revenue amounts to £2261; and the ordinary expenditure, to £1700. For new meters and extension of main-pipes, £100 has been expended. The dividend was fixed at £6 13s. 4d. per cent., the same as last year. Gas is to be sold at 3s. 9d. per 1000 cubic feet, as formerly; no charge being made for meters. One-third of the gas consumed in the street-lamps is given free. The quantity of gas made, as indicated by the station meter, was 12,122,500 feet, or equal to 9764 feet per ton of coal used. The unaccounted-for gas has been reduced to 7·69 per cent. of the quantity made. The meeting unanimously agreed to increase the salary of the Manager (Mr. Myers); and the Directors expressed themselves highly satisfied with the intelligent way in which he performed his duties.

The Laurencekirk Gas Company have been able, by the use of oil in gas making, to reduce the price of gas 5d. per 1000 cubic feet. A dividend at the rate of 5 per cent. has been paid.

At the annual meeting of the Leslie Gaslight Company, the balance-sheet showed a profit of £193. A dividend of 7½ per cent. was declared, while the price of gas was reduced by 5d. per 1000 cubic feet.

The shareholders of the Markinch (Fife) Gaslight Company, at their annual general meeting, have declared a dividend of 2 per cent. At one time 10 per cent. was a common dividend; but during the past twelve months great loss of gas has been enduring, owing to the laying of pipes along the streets in connection with the burgh sewage. The price of gas is to be continued at 5s. per 1000 feet.

It is quite evident that he will have to get up early who proposes to take in the Brechin Police Commissioners. Their treatment of an intimation by the Northern Electric Light Supply Company, that they were about to seek for a Provisional Order applying to the burgh, shows this, and makes quite amusing reading. A Committee reported that they had written to the Company stating that their intimation was not in proper form; asking, as the word limited was not included in the Company's name, whether it was registered; and requesting to be supplied with a list of partners, full information regarding the scheme and works to be put down, and what terms they would be prepared to offer should the Commission concur with the application. It was also stated that the Commissioners had the question of applying for a Provisional Order under consideration. A letter from the Scottish House-to-House Electricity Company was also read, stating they were to apply for a Provisional Order; and similar queries were sent them. No answer has yet been received from either Company.

The Scotch coal strike has now lasted nearly three weeks. I confess I was mistaken as to the power the men's leaders had over them, and that I never expected they would come out in such numbers, or remain out so long. It rather looks as if the masters had had some notion of the growing strength of the men's Unions, and had resolved to make an effort to break it. It is now all but certain that they have succeeded. Even the most enthusiastic striker cannot live upon promises alone; and the strike levy having turned out a failure, it is generally expected that the men will begin to think of resuming work, perhaps next week. All that the men have received for three weeks is 3s. 8d. each. In Fifeshire, they are better off, because of the funds which the men have accumulated; and there they are getting about 9s. per week. But this, again, is giving offence, because the money is collected, kept, and handled under strict rules; and those who have been in arrear with their subscriptions are struck off the benefit roll, while non-union men get nothing but the 3s. 8d. In some of the other districts, too, before the 3s. 8d. has been given, the subscription for membership in the Federation has been kept off, which, to say the least, is a very foolish proceeding on the part of the men who are engineering the strike, as it is leading to much discontent. There is dissension among the leaders also; and on all hands there is every indication that the strike is nearly at an end, and that the masters have gained. It is surprising how little coal from England has come north. During the strike in England last year, the railway companies were sending south as many sometimes as fifty trains of coal a day. Up till now, not a single train of English coal has come north on the Caledonian Railway. This Company have, it is reported, purchased 30,000 tons of coal in England, but have not yet required any of it. Fife coal, I observe, is being sent further south than usual, even into the Newbattle district. There seems to be abundance of coal in stock for present needs; and thus the men being idle is not of so much moment. As for gas-works, there seems to be no pinch anywhere. At the Edinburgh and Leith works there are stocks on hand that will last for three months, which removes all fear of being short there; and in other places the stocks have been well kept up, with the result that no inconvenience is likely to be felt.

Annual Excursion of the Dover Gas Company's Employees.—The customary summer outing of the workmen in the service of the Dover Gas Company and their wives took place last Wednesday; and the arrangements made by the Directors, aided by the Manager (Mr. R. Herring), were, as usual, such that an enjoyable day could not fail to result. Ramsgate was the town visited on this occasion; and the Company arrived at this popular seaside resort early in the morning. Some time was spent on the sea-front; and about noon dinner was served at the "Victoria" Temperance Hotel. The afternoon was pleasantly passed by a drive through Minster, Birchington, and Westgate, to Margate; and, on returning to Ramsgate, the party had tea together in the St. George's Hall. Before separating, the Chairman of the Company addressed a few kind words to the men, who heartily responded to his encouraging remarks with cheers for him and his colleagues.

Exhibitions of Gas Appliances.—Last week the Davis Gas-Stove Company, Limited, held exhibitions at Ely and Ventnor; Mrs. Springthorpe lecturing at the former, and Mrs. Hunter at the latter place. The Company have recently enlarged their London showroom, at 59, Queen Victoria Street, E.C., by the addition of more than double the superficial area formerly occupied. The new premises, situated as they are in a very central and convenient position, are in every way suited for the effective display of gas appliances; and they have been amply furnished with representative samples of the Company's latest productions.——An exhibition of gas appliances was recently held, under the auspices of the Wymondham Gas Company, in the Public Hall of that town, by Messrs. Fletcher, Russell, and Co., Limited; cookery lectures being given daily by Miss H. Edden. ——Last week, Messrs. W. Parkinson and Co. held an exhibition at Bourton-on-the-Water—Mrs. Marshall, of London, giving practical demonstrations on cookery twice daily; also at Wellesbourne and Kineton, with Miss Rorse's assistance as lecturer. This week they will be holding an exhibition in the Town Hall, West Bromwich, at which Miss Edith Sanderson will give cookery demonstrations twice daily.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *July* 14.

Sulphate of Ammonia.—The symptoms of weakness noticed during the week have, as frequently is the case, been initiated by the movements in the Scotch market, though, in the present instance, all the cheap sales seem to relate to second-hand parcels, held either by weak operators or else pressed for sale purposely to influence values. Generally the market is entirely without change. If anything, the position, through the absorption of stocks, and the extremely small make just now, is rather stronger; and a development of the present small demand would speedily give an impetus to prices. Viewing the shipments to the end of June, one is forcibly struck by the large increase of exports to Germany, which even exceed those of 1893 by about 5000 tons—a fact which, without further comment, refutes all statements and arguments made on behalf of nitrate of soda, and also as to a reduced consumption of sulphate in consequence of high prices. Germany is the leading country as regards the intelligent and economical use of manures; and her strong verdict in favour of sulphate must turn the scale and disarm all adverse criticism. It is fortunate that some of the other consuming countries have taken less during the first six months, or the fact of an inadequate supply of sulphate might have been brought forcibly home to consumers by the demand out-stripping the supply. Quotations have been somewhat irregular, but may be taken to-day at £13 15s. to £13 17s. 6d. Nitrate is also a little easier, and is now quoted at 9s. 3d. per cwt.

LONDON, *July* 14.

Tar Products.—Benzols continue flat and disappointing, notwithstanding the very largely decreased production, and the diversion of a large quantity for enriching gas. The prospect of more coke-ovens being brought into work (from which the residual products will be obtained) is not a hopeful feature for the tar products market, and is particularly against any probable advance in benzol. Solvent naphtha is in excellent request; and tar oils are moving off more freely. Pitch is firm; and the same remark applies to anthracene and carbolic acid. Business has been done during the week at the following prices: Tar, 13s. 6d. to 18s. 6d. Pitch, 29s. to 31s. Benzol, 90's, 11d.; 50's, 1s. 2d. Solvent naphtha, 1s. 4½d. Creosote, 1¾d. Creosote salts, 16s. Toluol, 1s. 5d. Cresylic acid, 1s. Crude benzol naphtha, 30 per cent., 5d. Carbolic acid, 60's, 1s. 8d. Anthracene, "A," 1s. 2d.; "B," 10½d.

Sulphate of Ammonia has fluctuated in value between £13 16s. 3d. and £14, less 3½ per cent., according to port of shipment. In the hope of lower prices, buyers are keeping off the market; but as stocks are low, and the production is now largely decreased—particularly through the Scotch coal strike—there is no reason for manufacturers to expect lower rates. Gas liquor is quoted at 11s. to 13s.

COAL TRADE REPORTS.

From Our Own Correspondents.

Lancashire Coal Trade.—Attention, of course, is just now mainly directed towards the probability of some permanent settlement of the wages question in the coal trade, arising out of the provisional terms of agreement which are at present under the consideration of the Miners' and Coalowners' Federations, prior to their sanction or otherwise by the Conciliation Board next Thursday. There is a good deal of division of opinion, both amongst the coalowners and the miners, upon the question; many of the coalowners feeling very strongly that too much concession has been made to the Miners' Federation, while a great number of the miners are strongly opposed to accepting the proposed reduction of 10 per cent. The suggested terms of settlement are, however, the result of patient negotiation. Both in the coal trade and amongst the responsible leaders of the miners, the belief prevails that an agreement will be come to on the basis which has been put forward. In view of the prospects of wages being reduced 10 per cent. and the question settled for a definite period, there has necessarily been some hanging back on the part of buyers with regard to placing further contracts just at present; and only a very limited business has been doing during the past week. So far as official list quotations are concerned, however, the Lancashire Coal Sales Association have decided that no change should be made. Prices generally remain at about 11s. to 11s. 6d. for best Wigan Arley; 10s. to 10s. 6d. for seconds Arley and Pemberton four-feet; 7s. 6d. to 8s. for common house-fire qualities; and 7s. to 7s. 6d. for steam and forge coals. With regard to gas coals, the bulk of the contracts have now been settled; and prices, so far as they can be ascertained, seem to average much on the basis I have previously given, ranging from about 7s., or perhaps a trifle less in some cases, for common screened gas coals, to 8s. and 8s. 6d. for the best screened Arley gas coals at the pit mouth. For shipment, a fair amount of activity is still maintained in meeting the requirements of markets that for the present are shut off from the supplies of Scotch coal; and 9s. to 9s. 3d. is being readily got for ordinary Lancashire steam coal delivered at the ports on the Mersey. Engine classes of fuel are plentiful, and, if anything, rather easier. Common sorts of slack are readily obtainable at 4s. to 4s. 6d.; medium, 5s. to 5s. 6d.; with some of the special sorts quoted at 5s. 9d. to 6s. 3d. per ton at the pit mouth.

Northern Coal Trade.—There has been a falling off in the demand for coal in the last few days; but it is mainly because the orders that have come in from Scotland have been disappointingly small. The local trade and that for shipment have, however, been above an average. Best Northumbrian steam coals have fallen to about 11s.; second qualities vary from 10s. to 10s. 6d.; while steam smalls are about 5s. per ton f.o.b. In regard to gas coals, a series of contracts for one of the great London Companies have been placed with non-associated collieries; and the price, though not officially stated, is believed to be about 7s. per ton f.o.b. But for odd cargoes, the price may be put as about 7s. 6d. per ton; and one or two collieries very favourably situated ask as high as 8s. Manufacturing coal is quiet; the strikes of the moulders on the Tyne and other rivers having closed several works, and reduced the consumption of this class of fuel. Coke is in steady request, though the foreign shipments are still low. The price of best Durham coke varies from 13s. 6d. to 14s. 6d. per ton f.o.b. In gas coke, there is no alteration in price; and the slightly increased output is well taken up. The labour difficulties are not yet over in the coal trade; and this should induce all the users of coal who can to keep up their stocks as fully as possible, so as to be prepared for any eventuality.

Scotch Coal Trade.—There may be said to be no change to record this week. Apart from the strike, holidays are general in the west and central districts, and little coal would have been passing. There are consequently no prices which can be given. Shipments were down to 24,849 tons—a decrease of 54,731 tons as compared with the preceding week, and of 132,295 tons as compared with the corresponding week of last year. For the year to date, the total shipments have been 3,622,369 tons—an increase over the corresponding period of last year of 144,339 tons.

The Darwen Gas and Water Undertakings.—The annual abstract of accounts and the estimates issued by the Borough Treasurer of Darwen (Mr. J. H. Ellison) show that the loss upon the gas-works in the past financial year was £157 18s., as compared with £1899 3s. for the year ended March 31, 1893. There was also a loss on the Water Department for the past year, amounting to £78 15s.

Sales of Shares.—At the Clitheroe Station Hotel, a number of perpetual gas annuities of the *Clitheroe Corporation* were lately offered for sale by public auction. There was brisk bidding; and good prices were obtained. An annuity of £15 realized £451; one of £7 10s. fetched £226; one of £7 produced £271; one of £57 10s. fell under the hammer at £1726; and a £14 7s. 6d. annuity brought £438.—— A considerable number of shares in the *Eastbourne Gas Company* were publicly sold in the town on Monday last week, and realized the following prices: £10 original shares, from £28 2s. 6d. to £29; £10 "C" shares, the same figures; and £10 "B" shares, from £21 2s. 6d. to £22 12s. 6d.

GAS AND WATER COMPANIES' STOCK AND SHARE LIST.

(For Stock Market Intelligence, see ante, p. 139.)

Issue.	Share	When ex-Dividend.	Dividend or Div. Bonus.	NAME.	Paid per Share	Closing Prices.	Rise or Fall in Wk.	Yield upon investment.
£			p. c.	GAS COMPANIES.				£ s. d.
590,000	10	12 Apl.	10⅞	Alliance & Dublin 10 p. c.	10	17½—18½	..	5 13 6
100,000	10	"	7½	Do. 7 p. c.	10	12—13	..	5 15 4
300,000	100	2 July	5	Australian (Sydney) 5 % Deb.	100	105—107	..	4 13 4
100,000	20	14 June	8	Bahia, Limited	20	9½—10½	..	15 3 10
900,000	5	11 May	6½	Bombay, Limited	5	5¾—5⅞	..	5 13 0
40,000	5	"	6½	Do. New	4	4—4½	..	5 15 6
380,000	Stck.	28 Feb.	11½	Brentford Consolidated	100	225—230	+2	5 0 0
180,000	"	"	8½	Do. New	100	168—173	..	4 18 3
220,000	Stck.	15 Mar.	11½	Brighton & Hove Original	100	210—215	..	5 6 11
888,500	Stck.	28 Feb.	5	Bristol	100	110—113	..	4 8 6
320,000	20	29 Mar.	11½	British	20	45—47	..	4 15 10
50,000	10	28 Feb.	11½	Bromley, Ordinary 10 p. c.	10	21½—22½	+½	5 2 2
51,510	10	"	8½	Do. 7 p. c.	10	16½—17½	+½	4 17 2
328,750	10	28 June	2	Buenos Ayres (New) Limited	10	5½—6	..	3 6 8
200,000	100	2 July	6	Do. 6 p. c. Deb.	100	98—101	..	5 18 10
150,000	20	12 July	8	Cagliari, Limited	20	25¼—26¼*	+½	6 0 8
550,000	Stck.	12 Apl.	12½	Commercial, Old Stock	100	260—265	..	4 14 4
165,000	"	"	9½	Do. New do.	100	192—197	..	4 16 5
160,762	"	14 June	4½	Do. 4½ p. c. Deb. do.	100	130—135	..	3 6 8
800,000	Stck.	14 June	13	Continental Union Limited	100	235—240	..	5 8 4
200,000	"	"	10	Do. 7 p. c. Pref.	100	210—215	..	4 13 0
535,000	Stck.	28 Feb.	5	Crystal Palace Ord. 5 p.c. Stk.	100	105—110	..	4 10 11
486,090	10	31 Jan.	11†	European, Limited	10	23½—24½	..	4 9 10
354,060	10	"	11†	Do. Partly paid	7½	16½—17½	..	4 14 3
5,646,590	Stck.	14 Feb.	12	Gaslight & Coke, A, Ordinary	100	240—245	..	4 17 11
100,000	"	"	4	Do. B, 4 p. c. max.	100	100—104	..	3 16 11
665,000	"	"	10	Do. C, D, & E, 10 p.c. Pf.	100	275—280	..	3 11 5
30,000	"	"	5	Do. F, 5 p. c. Prf.	100	130—135	..	3 14 1
60,000	"	"	7½	Do. G, 7½ p. c. do.	100	190—195	..	3 16 11
1,300,000	"	"	7	Do. H, 7 p. c. max	100	177—182	..	3 16 11
463,000	"	"	10	Do. J, 10 p. c. Prf.	100	272—277	..	3 12 3
476,000	"	"	6	Do. K, 6 p. c. Prf.	100	167—172	..	3 9 9
1,061,150	"	14 June	4	Do. 4 p. c. Deb. Stk.	100	127—130	..	3 1 6
294,850	"	"	4½	Do. 4½ p. c. do.	100	130—135	..	3 6 8
908,000	"	"	6	Do. 6 p. c. do	100	175—180	..	3 6 8
3,800,000	Stck.	11 May	12	Imperial Continental	100	220—225	+3	5 6 8
75,000	5	14 June	6	Malta & Mediterranean, Ltd.	5	4½—5	..	6 0 0
560,000	100	2 Apl.	5	Met. of Melbourne, 5p. c. Deb.	100	109—111	..	4 10 1
541,920	20	14 June	5	Monte Video, Limited	20	14—15	+½	6 13 4
150,000	5	30 May	8	Oriental, Limited	5	6—6½	+½	6 3 1
60,000	5	29 Mar.	7	Ottoman, Limited	5	3½—4½	..	7 7 4
166,870	10	31 Jan.	2	Pará Limited	10	1½—2	..	10 0 0
				People's Gas of Chicago—				
420,000	100	2 May	6	1st Mtg. Bds.	100	102—107	..	5 12 1
500,000	100	1 June	6	2nd Do.	100	95—100	..	6 0 0
150,000	10	26 Apl.	6	San Paulo, Limited	10	9½—10½	..	5 14 3
500,000	Stck.	28 Feb.	15½	South Metropolitan, A Stock	100	322—327	..	4 14 9
1,350,000	"	"	12	Do. B do.	100	267—272	..	4 8 3
260,000	"	"	13	Do. C do.	100	278—283	+1	4 11 10
750,000	"	12 July	5	Do. 5 p. c. Deb. Stk.	100	155—160*	+2	3 2 6
60,000	Stck.	28 Feb.	11½	Tottenham & Edm'nton, "A"	100	215—220	+5	5 4 7
				WATER COMPANIES.				
746,01 1	Stck.	28 June	10	Chelsea, Ordinary	100	280—285	+3	3 10 2
1,720,25 2	Stck.	12 Apl.	8	East London, Ordinary	100	225—230	..	3 9 7
544,440	"	28 June	4½	Do. 4½ p. c. Deb. Stk.	100	147—150	..	3 0 0
700,000	50	14 June	8½	Grand Junction	50	118—122	..	3 9 8
708,000	Stck.	28 Feb.	11½	Kent	100	295—300	..	3 16 8
1,043,800	100	28 June	9½	Lambeth, 10 p. c. max.	100	255—260	+2	3 13 1
406,200	100	"	7½	Do. 7½ p. c. max.	100	206—209	..	3 11 9
330,000	Stck.	29 Mar.	4	Do. 4 p. c. Deb. Stk.	100	132—135	..	2 19 3
500,000	100	14 Feb.	12½	New River, New Shares	100	372—377	+2	3 4 4
1,000,000	Stck.	31 Jan.	4	Do. 4 p. c. Deb. Stk	100	134—137	..	2 18 4
902,300	Stck.	14 June	6	S'thwk & V'xhall, 10 p. c. max.	100	168—173	+3	3 9 4
126,500	100	"	6	Do. D 7½ p. c. do.	100	147—150	..	4 0 0
1,155,066	Stck.	14 June	10	West Middlesex	100	268—273	+1	3 13 3

*Ex div.

† Next dividend will be at this rate.

The London County Council and the Water Companies' Undertakings.—At the meeting of the London County Council last Tuesday, the Chairman of the Water Committee (Mr. Bassett Hopkins) reported that, as the Council had agreed that eight separate Bills should be introduced to acquire the eight Water Companies' undertakings, his Committee had thought it advisable, having regard to the fact that these Bills will affect the supply of many districts outside the limits of the County of London, to invite a conference of representatives of extra-Metropolitan authorities, for the purpose of discussing the various matters which will necessarily have to be settled. A similar conference, which was attended with useful results, was held with these authorities in 1891. The Committee proposed that the conference should meet on the 30th inst., at Spring Gardens. He stated, in answer to Mr. Beachcroft, that the conference would be extended to all the urban and rural sanitary authorities in the districts outside London supplied by the Companies. The report was adopted.

The New Water-Works for Newport.—The Newport County Council have accepted the tender of Mr. J. Young, of Glasgow, for the construction of the new reservoir, &c., at Wentwood; his offer being £94,596. The estimate prepared by the Engineer was £96,170.

Water-Works for Cumberworth.—Colonel W. M. Ducat, R.E., held an inquiry at Denby Dale on the 5th inst. with reference to an application by the Cumberworth Local Board for power to borrow £3000 for works of water supply. It was stated that the Board (who had been advised by Mr. R. Crowther) proposed to obtain the water from a well situated on land in the locality belonging to a Mr. Lindley, who proposed to enter into a provisional agreement with the Local Board to construct a reservoir to contain not less than 100,000 gallons of water. The Denby Local Board (with whom the Cumberworth Board had previously been in negotiation for a supply) opposed the scheme; and the evidence given by their expert witnesses showed that they had some doubts as to the permanence of the supply from the well.

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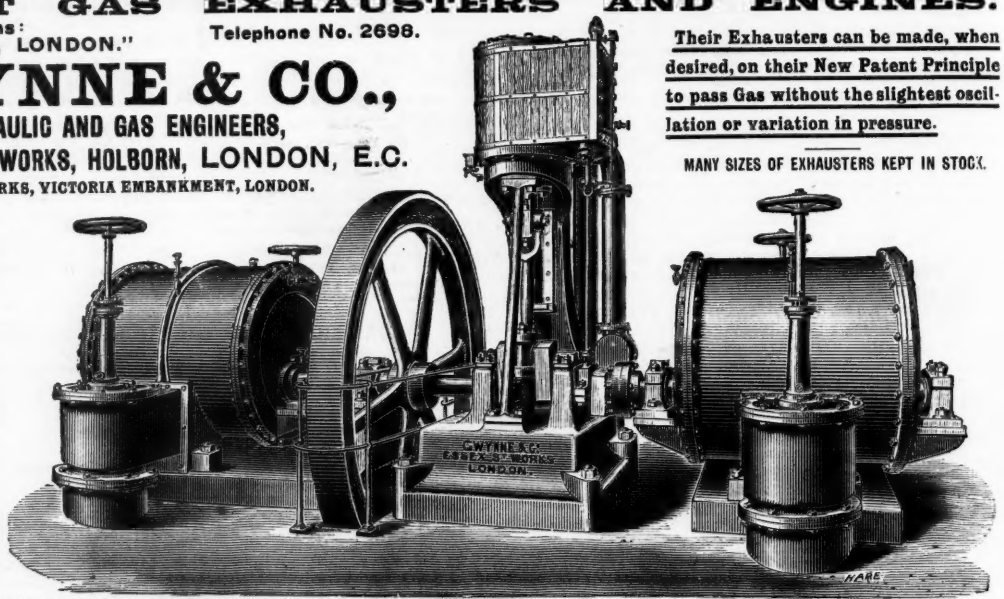

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Orders for Alterations in, or Stoppages of PERMANENT ADVERTISEMENTS should be received not later than the FIRST POST on SATURDAY.

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*** See Advertisement p. II., centre of JOURNAL.
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THE Directors of the Torquay Gas Company require the services of a CLERK to undertake the Management of their Rent and Collecting Office in Fleet Street. Age not less than 35. Salary £210 per annum.
Applications, in writing, accompanied with three testimonials, to be sent to the undersigned before the 25th inst.
A knowledge of gas matters desirable.
By order,
J. KITSON,
Secretary.
1, Vaughan Parade, Torquay,
July 13, 1894.

ABERTILLERY LOCAL BOARD.

APPOINTMENT OF WORKING GAS AND WATER MANAGER.

THE above Board will, at their Meeting to be held on Thursday, the 2nd day of August, 1894, proceed to the appointment of a person competent to undertake the duties of a WORKING GAS AND WATER MANAGER, under Supervision, at a Salary of £2 per week, with House, Coal, and Gas.
The person appointed will be required to have a thorough knowledge of the Manufacture and Distribution of Gas; also the Laying and Repairing of Water and Gas Mains, Service-Pipes, &c., and must be prepared to enter upon his duties on the 29th of September, 1894.
Applications, stating age, previous and present occupation, enclosing copies of testimonials (not exceeding three) of recent date, and endorsed "Working Manager," to be delivered at my Office not later than Four p.m., on Wednesday, the 1st of August, 1894.
Canvassing the members of the Board either personally or by agent, will be held to be a disqualification for the appointment.
By order,
JNO. ALEX. SHEPARD,
Clerk to the Board.
Town Hall, Tredegar,
June 30, 1894.

CYANIDES.

WANTED, Particulars of manufacture from Gas Liquor and Spent Oxide. Communications treated confidential.
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(GAS DEPARTMENT.)

TENDERS FOR COAL.

THE Gas Committee of the Lincoln Corporation invite TENDERS for the supply of 15,000 to 20,000 tons of screened GAS COAL and NUTS, to be delivered during a period commencing the 1st of September, 1894, and terminating the 30th of June, 1895.
Further Particulars and Forms of Tender may be obtained from the undersigned.
Sealed and endorsed tenders, addressed to the Chairman of the Gas Committee, must be delivered on or before the 27th inst.
The Committee do not bind themselves to accept the lowest or any tender.
JNO. CARTER,
Manager.
Gas Offices, Lincoln,
July 7, 1894.

ALWAYS a Buyer of Spent Oxide, Tar, and AMMONIACAL LIQUOR.
Apply to J. HARDMAN, Milton, STAFFORDSHIRE.

PATENTS FOR INVENTIONS.

J. C. CHAPMAN, M.I.M.E. and Fel. Chartered Inst. Patent Agents. ADVICE ON ALL MATTERS CONNECTED WITH ABOVE.
Information and Handbook on application.
70, CHANCERY LANE, LONDON, W.C.

OSWALDTWISTLE LOCAL BOARD.

THE Gas Committee invite Tenders for the TAR and LIQUOR produced at their Works for One Year from the 31st day of July, 1894.
The quantity of coal carbonized is about 3500 tons.
Further Particulars may be obtained from the Manager, Gas-Works, Church, near Accrington.
Tenders, endorsed "Tender for Tar," to be addressed to me, and to be delivered not later than Wednesday, the 25th of July.
WM. SANDEMAN,
Clerk.
Local Board Offices, Oswaldtwistle,
June 30, 1894.

TENDERS FOR TAR AND LIQUOR.

THE Directors of the Slough Gas and Coke Company are prepared to receive TENDERS for the purchase of the surplus TAR and AMMONIACAL LIQUOR (or either) produced at their Works, for a term of One Year, from the 30th of June, 1894.
The Slough Branch of the Grand Junction Canal is available.
The estimated quantities to be produced are: Tar, 24,000 gallons; and Liquor, 20,000 gallons.
The Products must be removed from the Works in Tank-Carts.
Sealed tenders, stating price for Tar per barrel of 36 gallons, and prices for Ammoniacal Liquor per 1000 gallons of different strengths, at the Company's Works, and endorsed "Tender for Tar and Liquor," to be delivered on or before Tuesday, the 24th of July inst.
The Directors do not bind themselves to accept the highest or any tender.
ARTHUR THOMAS,
Secretary.
Slough, Bucks., July 2, 1894.

SOWERBY BRIDGE LOCAL BOARD.
(GAS DEPARTMENT.)

NO. 1.

THE Gas Committee are prepared to receive TENDERS for the supply of about 1200 yards of 18-inch CAST-IRON MAINS, and about 350 yards of 12-inch CAST-IRON MAINS and IRREGULARS, BRANCHES, TEES, &c.
Forms of Tender and Specifications can be obtained on application to the Engineer.
NO. 2.
TENDERS are required for a 12-inch and 18-inch GOVERNOR, with designs of same offered. They must include Bye-Pass, Valves, and Connections fixed complete; the Committee providing Foundations. Separate price required for each size.
Tenders to be endorsed "Gas-Mains" or "Governor," and to be addressed to the Chairman of the Gas Committee, Gas-Works, Sowerby Bridge, not later than July 21, 1894.
The Gas Committee do not bind themselves to accept the lowest or any tender.
JOHN MARSLAND,
Engineer and Manager.
Gas-Works, Sowerby Bridge,
July 6, 1894.

WALLASEY GAS-WORKS.

TO TAR DISTILLERS AND OTHERS.

THE Wallasey Local Board are prepared to receive TENDERS for the purchase of the AMMONIACAL LIQUOR (about 2200 tons per annum), and also of the surplus GAS TAR (about 1200 tons per annum), produced from time to time at their Gas-Works, Great Float, near Birkenhead, during a period of One or more Years from the 30th of September next.
A Pipe is laid between the Gas-Works and the Great Float for the conveyance of the Tar and Liquor into the Contractor's Boats; and the Board will, if necessary, provide appliances on their own Siding to pump the products direct into the Contractor's Railway Tank-Wagons.
Any further information may be obtained on application to Mr. H. Ashton Hill, Gas and Water Manager to the Board.
Sealed tenders, endorsed "Tar, &c.," and addressed to the Chairman of the Gas and Water Committee, to be left at my office, as below, not later than Five o'clock in the afternoon of Monday, the 23rd inst.
The Board do not bind themselves to accept the highest or any tender.
By order,
W. DANGER,
Clerk to the Board.
Public Offices, Egremont, Cheshire,
July 12, 1894.

WANDSWORTH AND PUTNEY GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the ORDINARY GENERAL MEETING of the Proprietors of the above Company will be held at the Company's Offices, North Street, Wandsworth, on Thursday, the 9th of August next, at Five o'clock in the Evening precisely, for the purpose of a Declaration of a Dividend, and the transaction of the General Business of the Company.
The Transfer Books will be closed on and from the 27th of July till the 9th of August, both days inclusive.
By order,
WALTER CROMARTY,
Secretary.
Offices: North Street, Wandsworth,
July 13, 1894.

THE Knutsford Light and Water Company invite TENDERS for 1000 tons of best GAS COAL or GAS NUTS, screened (name prices for Gas Nuts and screened Gas Coal separately), to be delivered during Twelve Months commencing the 1st of August, 1894.
Tenders to be sent in to the Chairman, Knutsford, on or before the 30th inst.
The Directors do not bind themselves to accept the lowest or any tender.

UNEQUALLED.

Gas Companies are solicited to try Samples of the

MIRFIELD
BLACK BED GAS COAL.

Prices and Analysis on application.

MIRFIELD (GAS-COAL) COLLIERY COMPY.
RAVENSTHORPE, NEAR DEWSBURY.

LOW MOOR BLACK BED
GAS COAL.

YIELD OF GAS PER TON . 10,375 CUBIC FEET.
ILLUMINATING POWER . 17·50 SPERM CANDLES.
COKE . . . . . 75 PER CENT.

Prices, f.o.r. or f.o.b., on application to
GEORGE & JOHN HAIGH,
RAVENS LODGE AND CONYERS' COLLIERIES,
DEWSBURY.
A TRIAL IS RESPECTFULLY SOLICITED.

THORNLEY GAS COALS
WORKED BY THE
WEARDALE IRON AND COAL COMPANY, Ld.
OUT OF THEIR
THORNLEY AND WHEATLEY HILL COLLIERIES.

The Analysis made by Messrs. J. and H. T. Pattinson, Public Analysts for Northumberland, gives 10,500 cubic feet of Gas per ton, with an Illuminating Power of 16·3 Candles and 67·3 per cent. of Coke. The following is a Working Analysis made of these Coals by the Tudhoe and Sunderland Bridge Gas Company:—

[COPY.]
TUDHOE AND SUNDERLAND BRIDGE GAS COMPANY.
Tudhoe Gas-Works,
Spennymoor,
8th June, 1893.

Messrs. The
WEARDALE IRON & COAL COMPANY, LTD.

GENTLEMEN,
For the last two months we have used your **THORNLEY GAS COAL** exclusively at these gas-works; and I have pleasure in herewith giving you the actual results obtained during the trial.
Yield of Gas per ton: 10,300 cubic feet.
Yield of Coke: 13½ cwt.
Illuminating Power of Gas, average of a series of tests, **17 Sperm Candles.**
The Coke was of excellent quality.
The following is a complete ultimate Analysis of the Coal.

	Per Cent.
Carbon	83·128
Hydrogen	5·116
Oxygen	7·401
Nitrogen	0·585
Sulphur	0·620
Ash	3·130
Water	0·020
	100·000

Analysis of the Coke.

Carbon	93·31
Sulphur	0·61
Ash	5·00
Moisture	1·08
	100·00

I am, Gentlemen,
Yours truly,
A. B. COWAN,
Manager.

For Price, &c., apply to the
WEARDALE IRON & COAL Co., Ld.
QUAYSIDE, NEWCASTLE-ON-TYNE.

HOLMSIDE GAS COALS.

(Wrought out of Holmside and South Moor Collieries.)

PRESENT production 4000 tons per working day. Area of coal about 5000 acres, including the largest remaining workable proportion of pure HUTTON SEAM GAS COAL. Analysis of HOLMSIDE GAS COAL *in bulk as shipped* gives 10,500 cubic feet of Gas per ton, of an Illuminating Power of 16¼ candles. The Sulphur is about 1 per cent., and the Ash 1¾ per cent. The Coal cokes well, and leaves about 70 per cent. of excellent Coke. To show the progress of HOLMSIDE COALS, it may be mentioned that the quantity carbonized by the London Gas Companies in 1885 was about 200,000 tons; whereas the present consumption of HOLMSIDE COALS in London alone is at the rate of nearly

600,000 Tons per Annum

Full particulars on application to

MR. MARK ARCHER,

HOLMSIDE AND SOUTH MOOR OFFICES,

NEWCASTLE-ON-TYNE.

CAST-IRON PIPES

FOR GAS AND WATER.

Pipes, One to Six inch Bore, kept in Stock. Also a very large assortment of all sizes of Bends, T-pieces, and Specials ready for despatch on receipt of Order.

VALVES

FOR GAS, WATER, AND STEAM.

TELEGRAMS: "PIPES GLASGOW."

WM. MACLEOD & CO.,

56, ROBERTSON STREET, GLASGOW.

HEBBURN MAIN GAS COALS.

Yield of Gas per ton . . . . . 10,500 cubic feet.
Illuminating Power . . . . . 16·4 candles.
Coke . . . . . 68 per cent.

For prices, f.o.b. Ship or Delivered by Rail, apply to

THE WALLSEND & HEBBURN COAL COMPANY, LTD.

8 Lombard Street,
NEWCASTLE-ON-TYNE.

W. RICHARDSON, Fitter.

COKE BREAKERS,

PRICES REDUCED.

(THOMAS & SOMERVILLE'S PATENT.)

New Design, with two Cutting Rollers, making less Breeze than their old pattern.

For Exhauster Advertisement, see last week.

GEORGE WALLER & CO.,

PARK STREET, SOUTHWARK, E.C.,

And at STROUD, GLOUCESTERSHIRE.

T. B. KITTEL, SHEFFIELD.

CONTRACTS FOR SUPPLIES OF ANY OF THE PRINCIPAL

ENGLISH & SCOTCH CANNELS.

REAL SILKSTONE GAS COAL

ANALYSIS AND PRICES ON APPLICATION.

T. B. KITTEL, SHEFFIELD.

NEWBATTLE CANNEL.

Highest Results in Gas, & Excellent Coke.

QUOTATIONS ON APPLICATION TO

THE LOTHIAN COAL COMPANY,

LIMITED,

NEWBATTLE COLLIERIES,

DALKEITH, N.B.

BOLDON GAS COALS.

Worked by THE HARTON COAL CO., LTD.

Output about 3000 tons per day.

ANALYSIS—

Yield of Gas per ton . .	10,500	Cubic Feet.
Illuminating Power . .	16·9	Candles.
Coke	66·7	Coke.
Sulphur	0·86	Sulphur.
Ash	2·04	Ash.

Boldon Gas Coals are supplied under contract to

The Gaslight and Coke Company, South Metropolitan Gas Company, Commercial Gas Company, Imperial Continental Gas Association, European Gas Company, L'Union des Gaz (the Continental Union Gas Company), Crystal Palace District Gas Company, Bombay Gas Company, Ipswich Gaslight Company, Devonport Gas Company, Sunderland Gas Company, South Shields Gas Company, and to many other Companies at Home and Abroad.

For prices, &c., apply to the

HARTON COAL COMPANY,

LIMITED,

Newcastle-on-Tyne.

W. H. PARKINSON,

FITTER.

"BEAR CREEK"

The best KENTUCKY CANNEL in the Market.

Capacity of Mine, 160,000 Tons per Annum. Surface Drift Vein, 50 Inches Thick (*No Partings*).

AREA (ALL OWNED BY THIS COMPANY) 5000 TO 7000 ACRES (6000 TONS PER ACRE).

SAMPLE CARGO will demonstrate the extraordinary value of this Coal, and of the resultant Coke and other Bye-Products.

The unlimited quantity and REDUCED PRICE of this Material makes it the most satisfactory and economical Gas Enricher now available.

Result of Practical Working Test by Mr. John Methven, Engineer of The Gaslight and Coke Company, London, Aug. 8, 1893.

16·159 feet of 29·56 candles.
(484·770 candle-feet per 2240 lbs.)

Sperm Value	1638 lbs.
Specific Gravity	1200 (Water 1000)
Weight of 1 cubic foot	75 lbs.
Coke	944 lbs.
Carbon in Coke	80·83 per cent.
Ash " "	18·43 per cent.

Remarks by Mr. Methven—

"Sample received representing full section of working in mine. The whole sample was broken up and well mixed; and the practical results obtained represent the mean of 18 experiments. *The general results may be considered reliable.* The above results stamp this Cannel as being one of the most valuable obtainable. Not only does it possess a high yield of very rich gas, but its production of coke is of large quantity, and of a quality rarely found in cannels producing such a rich volume of gas. The coke is eminently suitable for mixing with coke from common coal; its percentage of ash being remarkably low."

Result of Laboratory Test by Mr. George R. Hislop, Gas Engineer, Paisley Scotland, Oct. 26, 1893.

14·630 feet of 41·24 candles.
(603·488 candle-feet per 2240 lbs.)

Sperm Value	2069 lbs.
Specific Gravity	1152 (Water 1000)
Weight of 1 cubic foot	72 lbs.
Coke	994 lbs.
Carbon in Coke	92·30 per cent.
Ash " "	7·70 per cent.

Remarks by Mr. Hislop—

"Very compact and cohesive, and uniform in composition and density. A cannel coal of exceptional value, and remarkable light-giving power and purity, affording a light and spongy coke of excellent quality. The Coal contains a very small percentage of both water and sulphur. Compared with Main Lesmahagow represented by 100, having regard to the value of the secondary products and cost of purification of the gas, this Coal is equal to 137·11."

COKE.—Briefly the "Bear Creek" Cannel produces a first-class Coke—that is, by itself, and unmixed with Coke from Common Coals—merchantable, comparing favourably with Coke from the Standard Gas Coals.

Correspondence solicited. Printed Reports, Analyses, and Letters of Commendation sent on application.

"BEAR-CREEK" CANNEL Mined and Owned by

The Log Mountain Coal, Coke, and Timber Company,

PINEVILLE, KENTUCKY, U.S.A.

Cable Address: "HULL, PINEVILLE" (A.B.C. Code.)

NOTE.—The President of the above Company (Mr. F. A. Hull) is now in Europe; and Letters or Telegrams addressed to him care of Low's Exchange, 57, Charing Cross, London, until July 31, will receive prompt attention.

ROBERT MARSHALL,
CANNEL COAL MERCHANT,
97, WELLINGTON STREET, GLASGOW.

Prices and Analysis of all the Scotch Cannels on Application.

LONDONDERRY GAS COALS
FROM THE
MARQUIS OF LONDONDERRY'S COLLIERIES,
COUNTY OF DURHAM.
Available output up to 5000 tons per day.
Yield of Gas 11,000 cubic feet per ton of Coal as per analysis by Mr. John Pattinson, F.C.S., F.I.S.
FOR PRICES AND PARTICULARS, APPLY TO
S. J. DITCHFIELD,
SEAHAM HARBOUR, COUNTY OF DURHAM.

THE SILICA FIRE-BRICK COMPANY,
OUGHTIBRIDGE, near SHEFFIELD,
MANUFACTURE
SILICA BLOCKS, BRICKS, AND CEMENT
OF SUPERIOR QUALITY
FOR GAS-FURNACES.
Trade Mark: "SILICA."
These Goods (largely used in Gas, Glass, Iron, and Steel Works) are, on account of their
GREATER DURABILITY
Strongly recommended where EXCESSIVE HEATS have to be maintained.

Awarded HIGHEST MEDAL and DIPLOMA at the Newcastle-on-Tyne Royal Mining and Industrial Exhibition, 1887,
for
CANNEL & COAL.

TYNE
BOGHEAD CANNEL.
Yield of Gas per ton . . . . . 13,155 cub. ft.
Illuminating Power . . . . . 38·22 candles.
Coke per ton . . . . . 1,301·88 lbs.

EAST PONTOP GAS COAL.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 70 per cent.

SOUTH PELAW MAIN GAS COAL.
Yield of Gas per ton . . . . . 10,500 cub. ft.
Illuminating Power . . . . . 16·3 candles.
Coke . . . . . 73·1 per cent.

For Prices and complete Analysis, apply to
THOS. W. DANCE & SONS,
COAL OWNERS, NEWCASTLE-ON-TYNE
OR
E. FOSTER & CO.,
21, JOHN STREET, ADELPHI, LONDON, W.C.

TROTTER, HAINES, & CORBETT,
Brettell's Estate
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.
Manufacturers of GAS-RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Proprietors of
BEST GLASSHOUSE POT & CRUCIBLE CLAY.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

HUNTER'S
OXIDE OF IRON.
JAMES HUNTER, LESSEE, MINER, AND SHIPPER OF
NATURAL IRISH BOG ORE.
This Estate yields the finest and most uniform quality in Ireland; and the quality is guaranteed.
Samples and Prices on application.
11, BAY STREET, PORT GLASGOW.
Telegrams: "HUNTER, PORT GLASGOW."
Established 1872.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
FILES OF BEST QUALITY
FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
SCREW STOCKS, TAPS AND DIES, SPANNERS, RATCHET BRACES, LIFTING JACKS, ANVILS, VICES,
AND ENGINEERS TOOLS GENERALLY.
London Office:
90, CANNON STREET, E.C.

JOHN BROWN & CO., LTD., SHEFFIELD,
Proprietors of
ALDWARKE MAIN CAR HOUSE & ROTHERHAM MAIN COLLIERIES, NEAR ROTHERHAM.
ALDWARKE MAIN GAS COAL
Analysis: 12,600 feet of 19-candle gas per ton.
Weight of illuminating power in pounds of sperm, 820·80. Very free from impurities.
Telegrams: "ATLAS SHEFFIELD."

WILLEY & Co.,
Gas Engineering Works, Commercial Road, Exeter,
MANUFACTURERS OF EVERY DESCRIPTION OF
GAS APPARATUS.

GASHOLDERS, Telescope and Single Lift, any size. Some of the largest in the Kingdom, erected by this Firm, are giving the highest satisfaction.

PLANS and SPECIFICATIONS furnished for Extensions and Enlargement of existing Works, adapting them to the most Improved and Modern Principle of Gas Manufacture.

PURIFIERS, CONDENSERS, WASHERS, ENGINES and EXHAUSTERS, STATION METERS and GOVERNORS, manufactured and erected.

Makers, by permission of that eminent authority MR. GEORGE LIVESEY, of his CELEBRATED PATENT WASHER, highly approved by all the Engineers of Works where adopted. Largely in demand.

Special reference and attention are invited to our
WET AND DRY METERS,
which have acquired a high reputation for the excellence of Materials and Workmanship; their durability and accuracy of Register guaranteed. They are used by several of the London Gas Companies, and over 200 Provincial Gas Companies.

Price Lists, Specifications, and Estimates provided for any work appertaining to Gas Lighting, from the Retort-House to the Drawing-Room.

CURLEY CANNEL.

Mr. JOHN METHVEN, Gas Engineer of The Gaslight and Coke Company, Beckton, has tested this famous Cannel, and says:

"The above results indisputably place this Cannel at the *head of the list* of the most valuable Cannel raised in this Kingdom."

Particulars, Analysis, and Prices to be had on application to

S. CHANDLER & SONS, PONTYBODKIN, NORTH WALES.

R. DEMPSTER & SONS, LTD.

Every Description of Gas Apparatus.

ELLAND, YORKS.

HEATHCOTE GAS COAL.

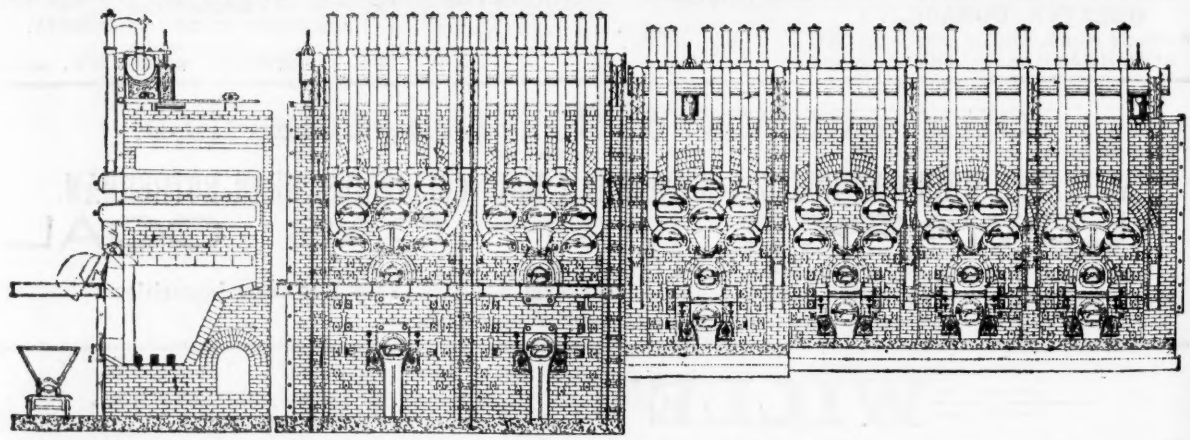
RICH IN ILLUMINATING POWER AND YIELD OF GAS.

ABOVE THE AVERAGE IN WEIGHT AND QUALITY OF COKE.

MAINTAINS A HIGH STANDARD IN RESIDUALS.

THE GRASSMOOR Co., LD., CHESTERFIELD.

HISLOP'S PATENT REGENERATIVE SETTINGS OF GAS-RETORTS.



THESE SETTINGS ARE POSITIVELY UNRIVALLED IN PRODUCTIVE CAPACITY, DURABILITY, AND SIMPLICITY OF MANAGEMENT. RETORTS OF ORDINARY DIMENSIONS, CARBONIZING FROM 18 TO 24 CWT. OF ENGLISH AND 21 TO 26 CWT. OF SCOTCH COAL PER 24 HOURS, DEPENDING UPON THE NATURE OF THE COAL, AND PRODUCING UP TO FULLY 13,000 CUBIC FEET PER MOUTHPIECE IN THE SAME TIME, AND WITH THE SMALLEST EXPENDITURE OF FUEL ATTAINABLE, AND RETURNING IN PROFIT THE ENTIRE COST OF ERECTION WITHIN TWELVE TO EIGHTEEN MONTHS, AND THUS REDUCING TO INSIGNIFICANCE THE INCREASED COST OF THESE SETTINGS OVER THE COMMON OR GENERATOR FURNACE SYSTEMS.

THESE SETTINGS ARE EXTENSIVELY ADOPTED, AND ARE ERECTED UPON THE SHALLOW AND STAGE FLOOR PLANS. THEY ARE ADAPTED TO ANY EXISTING ARRANGEMENTS, AND PERFECT SATISFACTION GUARANTEED. THE COMPOSITION OF FIRE-RESISTING AND OTHER SPECIAL FIRE-CLAY MATERIALS FURNISHED IS OF THE HIGHEST ORDER; AND THE SYSTEM AS A WHOLE, AS NOW PERFECTED, IS THE RESULT OF LONG EXPERIENCE AND CAREFUL STUDY OF THE PRINCIPLES OF GASEOUS FIRING.

Drawings and Specifications are furnished for the complete erection of Ovens, with or without Retort and Bench Mountings or complete erection undertaken if required, and carried out by specially Trained Workmen.

Further particulars may be obtained on application to the Patentee's Agents: C. M. HAMILTON, 5, Stuart Street, Shawlands, Glasgow; J. E. FISHER, Stourbridge; JOHN WALSH & SONS, Retort Builders, Halifax, Yorkshire; RICHARD TURNER, Retort Builder, Denton, Lancashire; and from the Principal Agent, R. F. HISLOP (son of Patentee), Gas-Works, Paisley, N.B.

HISLOP'S PATENT HYDRAULIC MAIN SEAL-REGULATING AND TAR-EXTRACTING VALVE is a *Sine quâ non*

TO THE SATISFACTORY WORKING OF THE HYDRAULIC MAIN UNDER THE REGENERATIVE AS WELL AS OTHER SYSTEMS OF RETORTS. BEING LARGELY ADOPTED AND AFFORDING THE HIGHEST SATISFACTION.

SPENT LIMES NO LONGER WASTE PRODUCTS

Under G. R. HISLOP'S Patents, all Spent Limes are most effectually, economically, and continuously recovered at from one-third to one-half the cost of New Lime. The results are a surprise to all who have inspected the process, and are entirely satisfactory to all now using it.

Descriptive Pamphlets and Terms from Agents as above.

THE WHESSOE FOUNDRY CO., LTD., DARLINGTON.

Established 1790.

MANUFACTURERS OF EVERY DESCRIPTION OF GAS PLANT,

FROM

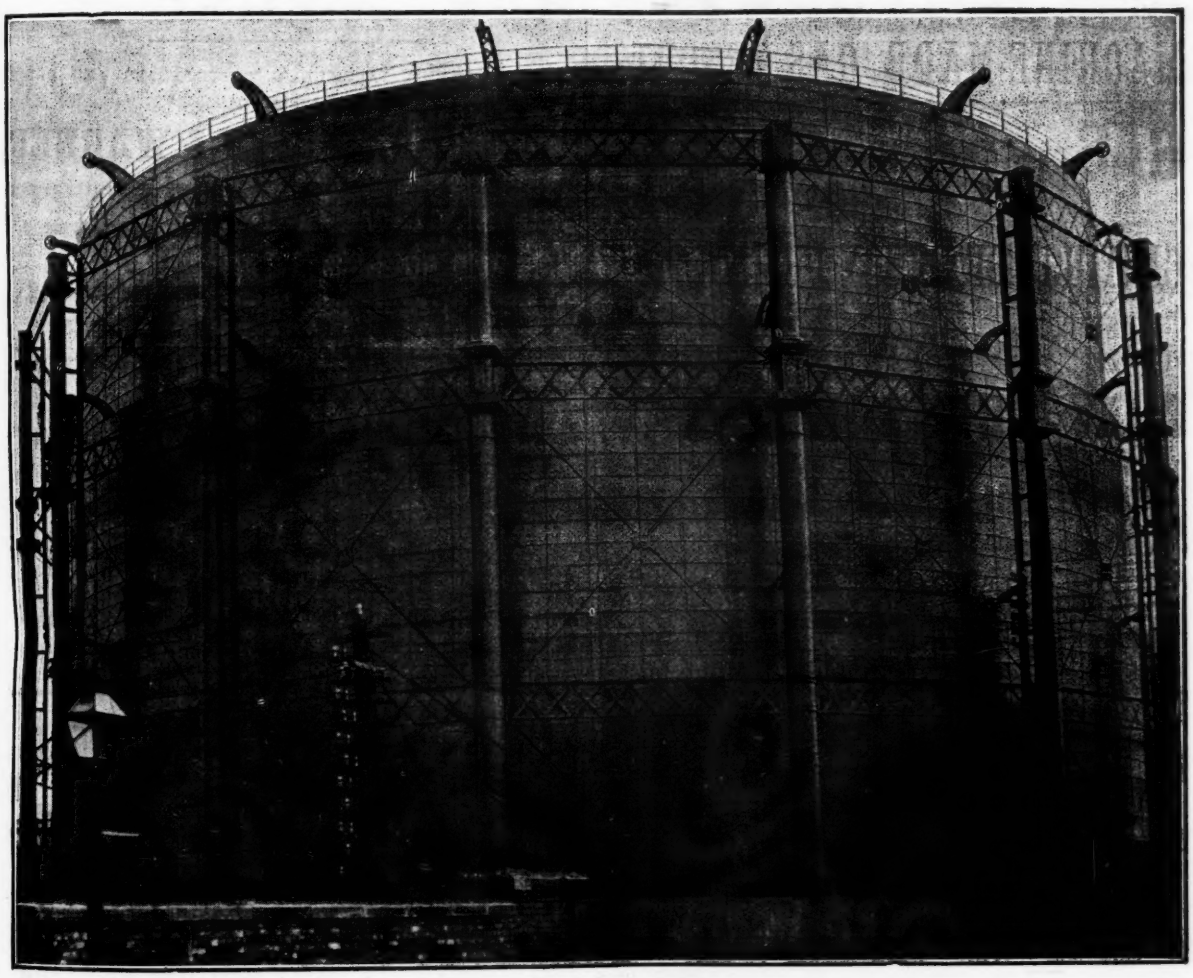
RETORTS

TO

GASHOLDERS,

FOR WHICH THEY HAVE THE NEWEST AND MOST MODERN MACHINERY.

GASHOLDERS CAN BE MADE OF ANY DIAMETER AND PUT TOGETHER AT THE WORKS.



Four-Lift Gasholder, 150 feet diameter, designed by S. Y. Shoubridge, Esq., Engineer and Manager, for the Salford Corporation Gas-Works.

Holders having a capacity of **8,000,000** Cubic Feet have been made and erected; the largest one being 181 feet diameter by 136 feet 9 inches deep. Riveted entirely with ⅞-inch diameter Hot Rivets.

WE ERECT GASHOLDERS EITHER WITH OR WITHOUT FRAMING.

NO ROYALTIES TO PAY FOR PATENTS.

SOLE MAKERS OF

COATES' IMPROVED PATENT FURNACE DOOR PROTECTOR

Which has been approved and adopted by the Gas Authorities at

SALFORD, MANCHESTER, BIRKENHEAD, STOCKTON, NEWCASTLE, DARLINGTON, &c.

Telegraphic Addresses: "WHESSOE, DARLINGTON." "WHESSOE, LONDON." | **T. COATES,** MANAGING DIRECTOR. | WORKS: DARLINGTON. LONDON OFFICE: 28, QUEEN STREET, E.C.

GAS AND WATER PIPES.

Telegraphic Address: "RITCHIE MIDDLESBROUGH."

WILLIAM INGHAM & SONS,

Incorporated with the Leeds Fire-Clay Company, Ltd.,

WORTLEY FIRE-CLAY WORKS,

Near LEEDS,

Have confidence in drawing the special attention of GAS ENGINEERS to the following advantages of their Retorts:—

1. Smooth Interior, preventing adhesion of Carbon.
2. They can be made in one piece up to 10 feet long.
3. Uniformity in thickness, ensuring equal Expansion and Contraction.

PATENT

MACHINE-MADE GAS-RETORTS.

GAS AND WATER PIPES

AND

CASTINGS OF EVERY DESCRIPTION.

MANUFACTURED BY THE

CLAY CROSS COMPANY,

CHESTERFIELD.

TRADE	TELEGRAMS:	LONDON AGENTS:
CXC	"JACKSON"	BECK & Co.
MARK.	CLAY CROSS.	130, GT. SUFFOLK ST., S.E.

GODDARD, MASSEY, & WARNER'S

IMPROVED

Sulphate of Ammonia Apparatus.

The most successful and approved Apparatus known up to the present time.

FOR REFERENCES, PARTICULARS, TESTIMONIALS, AND PRICE APPLY TO

GODDARD, MASSEY, & WARNER,

ENGINEERS,

NOTTINGHAM.

The Apparatus has been supplied to the following Firms—

BURT BOULTON, & HAYWOOD, SILVERTOWN, and ELING.
CHANCE BROTHERS, OLDBURY (Four Apparatus).
RUNCORN SOAP & ALKALI CO., Limited, RUNCORN.
NETHAM CHEMICAL CO., Limited, BRISTOL.
ANIMAL CHARCOAL CO., Limited, SHADWELL.
WM. BUTLER & CO., BRISTOL.
KEMPSON & CO., Pye Bridge.

And to the following Gas Companies and Corporations—

ILKESTON.	BURY.	CHORLEY.
WIDNES.	BRIGHOUSE.	WHITEHAVEN.
HALIFAX.	MARKET HARBRO'.	CHESTER.
ALTRINCHAM.	PRESCOT.	SOUTH SHIELDS.
DENTON.	SOWERBY BRIDGE.	LEEK.
ST. ALBANS.	LEICESTER.	IPSWICH.
DUKINFIELD.	DARWEN.	BOURNEMOUTH.
NORTHWICH.	NELSON.	SALFORD.
HUDDERSFIELD.	ORMSKIRK.	LUTON.
		HAMPTON COURT.

JONAS DRAKE & SON,

LONDON OFFICE:
60, QUEEN VICTORIA ST., E.C.

OVENDEN, HALIFAX.

TELEGRAPHIC ADDRESSES:
"DRAKESON, HALIFAX."
"ECLAIRAGE, LONDON."

TELEPHONE No. 43.
HALIFAX EXCHANGE.

GAS ENGINEERS,
CONTRACTORS,
IRONFOUNDERS,

BUILDERS AND ERECTORS OF EVERY DESCRIPTION OF OVENS, BENCHES, KILNS, FURNACES, &c.

RETORT SETTERS,
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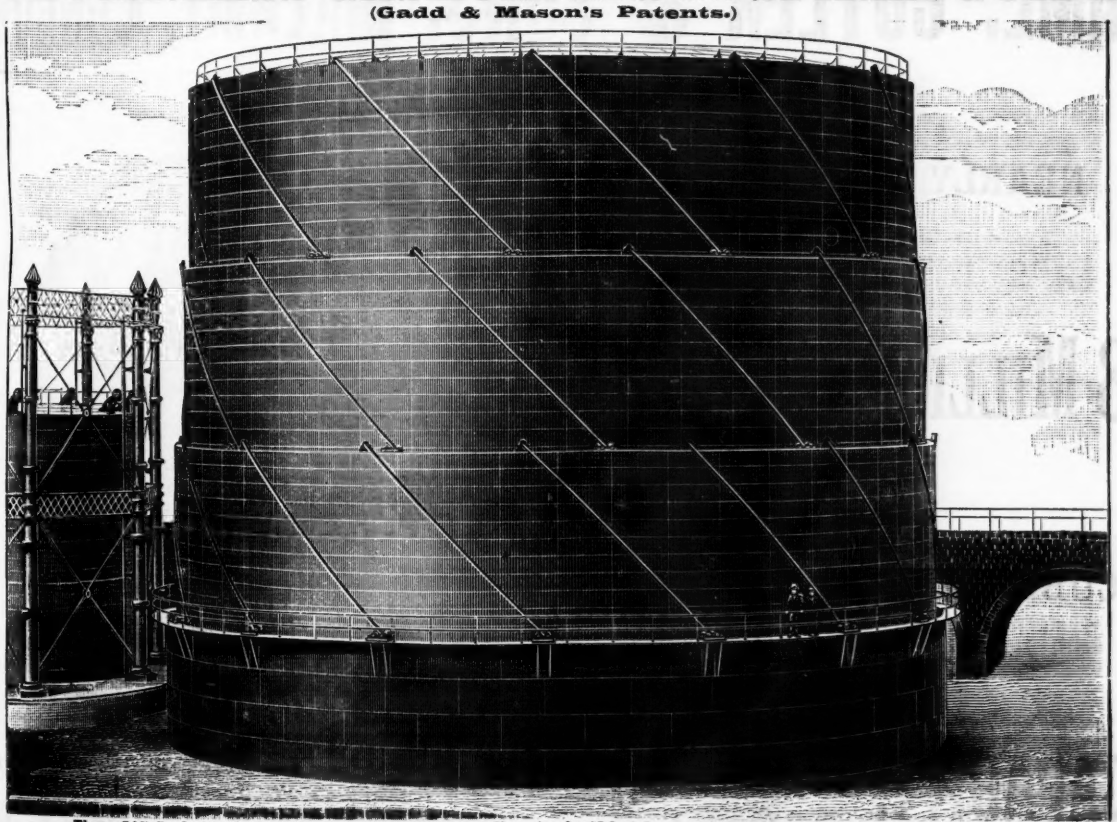

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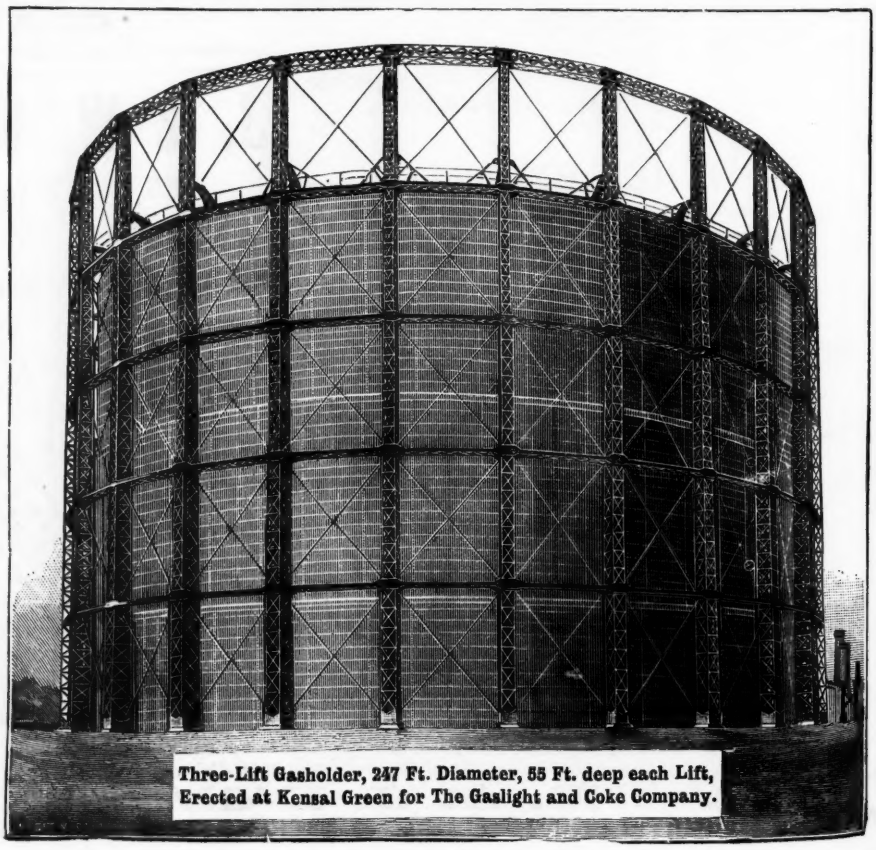

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